

Effect of Carbonated Beverages on Hard Tissue of Teeth and Light-Curing Filling Materials

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Abstract

Introduction: In recent years, consumption of soft drinks increased among young people. The substance of dental hard tissues changes under the conditions of constant exposure to dyes drinks. Our enamel is constantly exposed to dyes contained in carbonated beverages. It is the right choice of filling materials, which maintains the appearance of existing tooth fillings, taking into account the consumption of staining beverages.

Materials and Methods: Thirty teeth were prepared by cavities of 5 class by Black on maxillary incisors. Company 3M Espe – Vitremer and composite Filtek Z 550 were used as filling materials. Sealed teeth in equal amounts were placed for a month in carbonated beverages “Tarhun” (Group 1) and “Baikal” (Group 2). After careful washout of dye and drying, the thin sections were produced in the longitudinal direction of the teeth on the border of the filling material and hard tissue. Photomicrographs were taken of each slice, and the comparative histological characteristics were made.

Results: The most coloration was in the first group teeth which were sealed by Vitremer, especially in the hard tissues of tooth. Microcracks were found in Group 1 and Group 2, which were sealed by Vitremer also.

Conclusion: The research showed a negative effects of carbonated beverages containing coloring agents on the hard tissue of teeth and filling materials. The nanocomposite Filtek Z 550 is most resistant to the effects of food dyes than Vitremer. This is due to it's chemical composition and characteristics.

Key words: Enamel, Light-curing filling materials, Soft drinks

INTRODUCTION

In recent years, consumption of soft drinks increased among young people. This is seen in the survey of 153 students of the Volgograd State Medical University which showed that carbonated beverages consumed almost all young people (96.7% of responses). About daily use of drinks reported 64 people (41, 8% of responses). A third of the respondents consume carbonated drinks not more than

1 time a week (37, 2% of responses), 17.6% – not more than ones a month. Most students consume drinks between meals (43.8% of responses).^[1] Furthermore, children use a lot of sugar that reduces personal oral hygiene and increases incidence of dental caries.^[2]

The substance of dental hard tissues changes under the conditions of constant exposure to dyes drinks. Ions of strontium, copper, aluminum, and potassium uniformly distributed throughout the thickness of the enamel.^[3-7] According to the data of conventional, inorganic materials comprise 98.7% of the dry weight of the enamel, and the share of organic substances account for 1.3%.^[8] Our enamel is constantly exposed to dyes contained in carbonated beverages. Speaking about the chemical composition of the enamel, it is necessary to mention anameloid – phase at the boundary between the enamel and dentin.^[6] Enamel is

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a buffer system for acids, acting on its surface. Displacing calcium and ions H^+/H_3O^+ bind to hydroxyapatite. This reduces the ability of hydroxyapatite counteract acid due to reduction of excess calcium.^[4] The age of the tooth, enamel demineralization, acidity, oral fluid, properties permeate, the structure, and composition of the enamel effect on the enamel permeability.^[5] Speaking of dental enamel permeability, it should be noted that the level of the enamel permeability changes under the influence of organic acids, primarily lactic, acetic, and propionic. Due to ion exchange, protons can be absorbed by enamel without destruction of its structure until certain point.^[3] The permeability of the enamel depends on the concentration of hydrogen ions. This may be due to changes in the structure of the enamel, because increasing of acid concentration in the solution, it increases the solubility of enamel. Hybrid restorative and cosmetic material Vitremer, marketed by 3M ESPE consists of tinting glass ionomer powders, glass-liquid primer, and varnish to give shine. Restorative and cosmetic glass ionomer Vitremer material have all the basic virtues of the glass ionomer cements – adhesion to tooth structure, release of fluoride in them, and biocompatibility. Filtek Z 550 – light-curing restorative material developed by 3M Corporation known as based on nanocomposites. Due to the high density of the composite, it is well adjacent to the edges of teeth. Actively elastic material is used for sandwich technique. Based on the foregoing, it is the right choice of filling materials maintains the appearance of existing tooth fillings, taking into account the consumption of staining beverages.

Aim

The aim of the study was to provide a comparative analysis of morphological changes in the hard tissue of teeth and light-curing filling materials that have arisen under the influence of various carbonated drinks containing food dyes.

MATERIALS AND METHODS

Thirty teeth were prepared by cavities of 5 class by Black on maxillary incisors. Company 3M Espe – Vitremer and composite Filtek Z 550 were used as filling materials. Sealed teeth in equal amounts were placed for a month in carbonated beverages “Tarhun” (Group 1) and “Baikal” (Group 2). A selection of drinks was chosen due to dyes, for example, in the “Tarhun” includes tartrazine and brilliant blue, and the drink “Baikal” – Eleutherococcus extracts, black tea and sugar color (E 150d). Carbonated water “Essentuki” was selected as the control group (Group 3).

After careful washout of dye and drying, the thin sections were produced in the longitudinal direction of the teeth

on the border of the filling material and hard tissue. Photomicrographs were taken of each slice, and the comparative histological characteristics were made.

RESULTS

Results of survey of 153 students of the Volgograd State Medical University which showed that carbonated beverages consumed almost all young people (96.7% of responses) Table 1.

This survey shows that the most popular drinks are bottled tea, Pepsi, and Sprite.

The most number of students drink carbonated beverages between meals or after meal [Table 2].

Effects of carbonated drinks to the hard tissue of teeth and filling materials are shown in Table 3.

The most coloration was revealed in the first group of tooth, which were sealed by Vitremer and placed in “Tarhun” drink. Microcracks were found on the boarder of filling material and hard tissues of tooth of 1 and 2 groups, which were sealed by Vitremer also.

Table 1: Types of carbonated beverages consumed

Name of drink	Number of people	% answers
Pepsi, Coca-Cola	39	25.5
Bottled tea	46	30.1
Sprite	28	18.3
Mineral water	9	5.9
Fanta	7	4.6
Juice	7	4.6
Nothing	9	5.9

Table 2: The time of consumption of drinks

Time	Number of people	% answers
Before meal	3	2.0
At the same time	20	13.1
After meal	63	41.2
Between meals	67	43.8

Table 3: Effects of carbonated drinks to the hard tissue of teeth and filling materials

Property	Coloration			Microcracks		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
Vitremer	++	+	-	+	+	-
Filtek Z550	-	-	-	-	-	-
Cement of teeth	+++	+++	-			
Enamel	++	++	-			

-: The absence of signs; +: A sign expressed slightly; ++: A sign clearly expressed; +++: A sign intensity expressed

DISCUSSION

Filtek Z 550 – light-curing restorative material developed by 3M Corporation known as based on nanocomposites. Due to the high density of the composite, it is well adjacent to the edges of teeth. We believe that it is the chemical composition and properties of nanocomposite Filtek Z 550 can stand to the impact of different food dyes, which are contained in carbonated beverages. At the same time, the hard tissue of teeth staining causes permeability of enamel and cement, their properties. Restorative and cosmetic glass ionomer Vitremer material has all the basic virtues of the glass ionomer cements – adhesion to tooth structure, release of fluoride in them, and biocompatibility. You can also assume that the acid resistance of the nanocomposite Filtek is more than the Vitremer. From this, it can be assumed that the resistance, adhesion, and also the quality of the fillings deteriorate in Vitremer under the influence of the dyes.^[9,10]

CONCLUSION

The research showed a negative effects of carbonated beverages containing coloring agents on the hard tissue of teeth and filling materials. The nanocomposite Filtek

Z 550 is most resistant to the effects of food dyes than Vitremer. This is due to it's chemical composition and characteristics.

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