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Research Article

Effect of Coloring Beverages on Different Esthetic Restorative Materials in Primary Teeth

Hanaa Mahmoud Shalan[1]*, Rizk A Alagami[2] and Mayy A Hasan[3]

[1]*Associate Professor of Pediatric Dentistry, Faculty of Dentistry, Mansoura University, Egypt*

[2]*Lecturer of Pediatric Dentistry, Faculty of Dentistry, Mansoura University, Egypt*

[3]*BDS 2010, Misr International University, Pediatric Dentistry Diploma 2013, Mansoura University, Egypt*

***Corresponding Author:** Hanaa Mahmoud Shalan, Associate Professor of Pediatric Dentistry, Faculty of Dentistry, Mansoura University, Egypt.

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Abstract

Objectives: To evaluate the effect of coloring beverages on esthetic restorations in primary teeth.

Methods: Class V cavities were prepared on two hundred and eighty primary molars, divided into two main groups: group I (glass ionomer) and group II (compomer). Each group divided into four subgroups according to the coloring beverage: subgroup A (control, distilled water), subgroup B (cola), subgroup C (orange juice), and subgroup D (chocolate milk). Subgroups B, C, D were further subdivided into: a (non-brushed) and b (brushed). Teeth were immersed in beverages for three hours per day and the rest of day in distilled water for 30 days. Brushed subgroups were brushed for one minute daily. Color change was evaluated using (CIE L*a*b*). Data was collected, tabulated, and statistically analyzed by SPSS using Student t-test.

Results: Glass ionomer subgroups showed higher susceptibility to discoloration than compomer. Most significant color change was recorded for non-brushed glass ionomer subgroup immersed in cola ($P < 0.001$). Brushed subgroups showed less color change than non-brushed of same material and beverage.

Conclusion: Coloring beverages adversely affected the esthetic restorative materials. Tooth brushing have valuable effect on the decreasing susceptibility to discoloration.

Keywords: Glass Ionomer; Compomer; Beverages; Discoloration

Introduction

The most common restorative materials used in pediatric dentistry are glass ionomers (GIC), resin modified glass ionomers (RMGIC), compomers, and resin composites. These materials are preferred due to their esthetic appearance [1]. The success of the dental restoration depends on the physical properties of the material [2].

Discoloration of restorative materials is a frequent problem. It may be due to intrinsic or extrinsic factors. Intrinsic factors involve changes within the material itself depending on the composition of the matrix and the type of bonding between the fillers and matrix. Extrinsic factors involve adsorption or absorption of stains in the oral cavity. Surface roughness is one of the reasons for extrinsic discoloration [3].

Low pH of oral environment leads to degradation of surface integrity of restorative material. In short term or long term, the acidic environment destructs the material polymer network, affecting the chemical and physical properties [4,5].

Tooth brushing is very important for oral hygiene. Improper brushing may be harmful to teeth, causing abrasion. It may affect restorative materials with poor properties (composition, and quality) [6].

Hotwani., *et al.* [17] compared the color stability of giomer (Beautifil II) and RMGIC (Fuji II LC), immersed in orange juice, milk, and coke. They showed that. giomer (Beautifil II) has better color stability than RMGIC (Fuji II LC) due to the small size particles of filler which provided smooth surface so, retained less surface stain. Specimens immersed in coke exhibited maximum color changes comparing to orange juice and milk.

Bezgin., *et al*. [8] evaluated the color changes of three different restorative materials; Compomer (Dyract AP), Glass ionomer cement (Ionofill Molar AC), and composite resin (Filtek Z250) after immersion in different beverages; cheery juice, cola, and chocolate milk. Most significant color change occurred in groups that were immersed in chocolate milk. Glass ionomer cements showed less color changes, than compomer, while composite resin showed the greatest color change. This study was carried out because of limited available data that concerning the effect of coloring beverage on esthetic restorative materials in primary teeth.

Materials and Methods

Class V cavities were prepared on buccal surface of two hundred and eighty extracted primary molars. Teeth were randomly divided into two equal groups (n=140) according to type of restorative material used: Group I: Glass ionomer (Ionolux, VOCO, Cuxhaven, Germany) and Group II: Compomer (Glassiosite, VOCO, Cuxhaven, Germany). Each group was divided into four subgroups according to beverage used: Subgroup A (Control, distilled water), Subgroup B (Cola, Coca-Cola, Coca-Cola Co., Egypt), Subgroup C (Orange juice, Best, Egyptian Canning Co. Egypt), and Subgroup D (Chocolate milk, Mix, Juhayna, Egypt). Subgroups B, C, and D were further subdivided into 2 divisions: a: non-brushed, and b: brushed. pH of the beverages was measured.

Specimens were immersed in corresponding beverage for three hours per day, and rest of day in distilled water. All divisions (b) specimens were brushed daily using electric tooth brush for one minute. This procedure was repeated for thirty days.

The color measurement of each specimen was performed using computational technique with a combination of a digital camera, and image processing software. The images were taken at maximum resolution (1280 × 1024 pixels) and connected with an IBM compatible personal computer using a fixed magnification of 90X. The images were recorded. RGB model was used in which each sensor captured the intensity of the light in the red (R), green (G) or blue (B) spectrum. In order to calibrate the digital color system, the color values of 32 color charts were measured. L*a*b* values was calibrated on the basis of the RGB measurements from the camera. Color difference was characterized using the Commission International d'Eclairage L*a*b* color space (CIE L*a*b*). Total color differences for each subgroup were expressed by the formula: $\Delta E^* = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]^{1/2}$

Where ΔL, Δa, and Δb were the differences in L*, a*, and b* values of the control group and each subgroup. The L* value is a measure of the whiteness or brightness of an object (which range from 0 - 100). The a* value is a measure of redness (positive a*) or greenness (negative a*). The b* value is a measure of yellowness (positive b*) or blueness (negative b*) [7].

Results

Data was collected, tabulated, and statistically analyzed by SPSS (Statistical package for social science) version 23.0. Student t-test was used to compare between different subgroups. P value < 0.05 was considered statistically significant.

Results (Table 1) showed high significant difference between the glass ionomer and compomer in cola subgroups either in non-brushed and brushed conditions. Also, there was significant difference between the glass ionomer and compomer in brushed chocolate milk subgroups. No significant difference was recorded between other subgroups.

	Group I	Group II	P
	Mean ± SD	Mean ± SD	
Subgroup Ba	12.24 ± 3.06	6.73 ± 1.68	< 0.001*
Subgroup Ca	4.20 ± 1.4	3.8 ± 0.95	0.29
Subgroup Da	3.60 ± 1.2	2.94 ± 0.91	0.057
Subgroup Bb	6.38 ± 1.59	3.85 ± 0.96	< 0.001*
Subgroup Cb	3.46 ± 1.1	3.63 ± 0.91	0.59
Subgroup Db	3.36 ± 0.84	2.61 ± 0.58	0.002*

Table 1*:* Color change of esthetic restorations regarding beverage and brushing.

Regarding the effect of brushing (Table 2), high significant difference was recorded between non-brushed and brushed subgroups of cola in both glass ionomer and compomer. Regarding the beverage, cola showed high significant color difference (ΔE) followed by orange juice and chocolate milk. In non-brushed subgroup of both material; cola showed significant color difference with orange juice and chocolate milk (P < 0.001). In the brushed subgroups, glass ionomer subgroups showed significant color difference (ΔE) between each other (P < 0.001), while in compomer, chocolate milk subgroup showed significant difference with cola and orange juice (P < 0.001).

	Division a	Division b	P
	Mean ± SD	Mean ± SD	
Subgroup IB	12.24 ± 3.06^{qr}	6.38 ± 1.59	< 0.001*
Subgroup IC	4.20 ± 1.4^{q}	3.46 ± 1.1	0.07
Subgroup ID	3.60 ± 1.2^{r}	3.36 ± 0.84	0.47
P value	< 0.001*	< 0.001*	
Subgroup IIB	6.73 ± 1.68^{tu}	3.85 ± 0.96^{m}	< 0.001*
Subgroup IIC	3.8 ± 0.95^{t}	3.63 ± 0.91^{o}	0.56
Subgroup IID	2.94 ± 0.91^{u}	2.61 ± 0.58^{mo}	0.17
P value	< 0.001*	< 0.001*	

Table 2: Effect of beverage and brushing on the color change of the restorations.

Figure 1: PSignificant color change in glass ionomer cola subgroups; non-brushed (IBa) and brushed (IBb). Least color changes in compomer; non-brushed (IIDa) and brushed (IIDb).

Discussion

Esthetic appearance is a main concern of adult as well as children. Variety of esthetic restorative dental materials are available in pediatric dentistry. Many considerations must be in concern when restoring primary teeth. Compomer and glass ionomer are commonly used in restoring deciduous teeth due to their higher fluoride release, esthetic appearance and short chairside time [1].

Increased consumption of beverages among children is very obvious. Food and drinks affect pH in the oral cavity, therefor, teeth and dental restoration may be affected [4,8].

Tooth brushing is a basic dental care at home. Brushing is very common cause of dental wear. Proper brushing technique, time and force are important to preserve teeth and dental restoration intact [6].

In this study, class V cavity was selected to be prepared because erosion is a common lesion in esthetic zone. Restorative materials were applied directly into the cavity as one increment because cavities were shallow and narrow. Cola, orange juice, and chocolate milk are selected as they are the most commonly consumed, have different pH, and great staining ability [9,10]. Electric tooth brush with toothpaste was used to standardize the abrasive effect of brushing.

To simulate the actual situations, specimens were immersed in beverages for three hours per day, and rest of day they were stored in distilled water; similar to Bezgin., *et al* [8]. Distilled water was used for the control groups instead of artificial saliva. Turssi., *et al*. [11] proved that the micromorphology of resin based materials that stored in either distilled water or artificial saliva showed similar result.

Color change is considered a major esthetic failure. Proper shade selection is an important consideration. Also, the properties of the material play an important role in color stability [3]. Standard Commission International de L`Eclairage (CIE Lab) system was utilized. This system provided information about location of object color in a uniform 3D color space, so it allowed detection of small color difference. Color difference was calculated as ΔE which values less than 3.3 was clinically considered insignificant [12,13].

In color evaluation, regarding to the material, both materials showed color change in all beverages. The color change of the glass ionomer was higher than the compomer. This may be explained as fluoride releasing materials released ions greatly when subjected to pH variations, great ionic exchange occurred, resulting in color change [14,15].

Compomer exhibited less color change than glass ionomer. This result is supported by Mohan., *et al*. [16] who stated that the hydrophobic nature of the material allowed less water absorption. Hotwani., *et al*. [17] claimed that the presence of small filler particles allowed smooth surface so, less stain retained. Contrary to our results, Bagheri., *et al*. [18] suggested that GIC showed minimal discoloration. They attributed this low susceptibility to the discoloration, to the glass particles and high water content in GIC. Their result is not in a line with our study because of the few number of specimens as they tested three specimens only.

Regarding to the type of beverage, higher ΔE values were recorded in specimens immersed in cola followed by, orange juice subgroups. Specimens of chocolate milk subgroups were least affected. These results come in agreement with Tunc., *et al*. [9], Hotwani., *et al.* [17], Lopes., *et al*. [19], Tanthanuch and Kukiattrakoon [20] and Adusumilli., *et al* [21]. They attributed this was due to the low pH that caused surface roughness which enhanced accumulation of stains. In contrast, Bezgin., *et al.* [8] stated that chocolate milk caused more discoloration than cola. Bagheri., *et al*. [18], Gupta., *et al*. [22] and Lee., *et al*. [23] correlated between the presence of colorant in beverage and discoloration of the restorative material.

Regarding to brushing, brushed subgroups showed less color change than non-brushed subgroups as the stains on the external surface were removed by brushing. This result is supported by Bezgin., *et al* [8].

Limitation

This study was conducted *in vitro* and dentists should consider some factors when performing it clinically as type of saliva, bacteria and occlusion therefore further clinical studies are needed.

Conclusion

Glass ionomer showed great color change. Cola had the greatest undesirable effect on the color. Tooth brushing decreased the color changes as it removed the adsorbed colorant.

Conflict of Interest

The authors declared no conflict of interest

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Nil.

Bibliography

1. McDonald RE and Avery DR. "Restorative Dentistry". In: Dean JA, Donly KJ. (eds). Dentistry for the Child and Adolescent. Tenth edition. Missouri. Elsevier (2016): 185-186.
2. Jain C., *et al*. "Spectrophotometric evaluation of the color changes of different feldspathic porcelains after exposure to commonly consumed beverages". *European Journal of Dentistry* 7.2 (2013): 172-180.
3. Patel SB., *et al*. "The effect of surface finishing and storage solutions on the color stability of resin-based composites". *Journal of the American Dental Association* 135.5 (2004): 587-594.
4. Kelleher M and Bishop K. "Tooth surface loss: An overview". *British Dental Journal* 186.2 (1999): 61-66.
5. Yap AU., *et al*. "Environmental damage and occlusal contact area wear of composite restoratives". *Journal of Oral Rehabilitation* 29.1 (2002): 87-97.
6. Yap AU., *et al*. "Effect of hygiene maintenance procedures on surface roughness of composite restoratives". *Operative Dentistry* 30.1 (2005): 99-1047.
7. Leon K., *et al*. "Color measurment in L* a * b* units from RGB digital images". *Food Research International* 39.10 (2006): 1084-1091.
8. Bezgin T., *et al*. "Effect of toothbrushing on color changes of esthetic restorative materials". *Journal of Esthetic and Restorative Dentistry* 27.1 (2015): S65-S73.
9. Tunc ES., *et al*. "The effects of children`s drinks on color stability of various restorative materials". *Journal of Clinical Pediatric Dentistry* 34.2 (2010): 147-150.
10. Curtin JA., *et al*. "In vitro staining of resin composites by liquids ingested by children". *Pediatric Dentistry* 30.4 (2008): 317-322.
11. Turssi CP., *et al*. "Effect of storage media upon the surface micromorphology of resin-based restorative materials". *Journal of Oral Rehabilitation* 29.9 (2002): 864-871.
12. Vargas MA., *et al*. "Color stability of ionomer and resin composite restoratives". *Operative Dentistry* 26 (2001): 166-171.
13. Vichi A., *et al*. "Color and opacity variations in three different resin based composite products after water aging". *Dental Materials* 20.6 (2004): 530-534.
14. Forss H. "Release of fluoride and other elements from light cured glass ionomers in neutral and acidic conditions". *Journal of Dental Research* 72.8 (1993): 1257-1262.
15. Williams JA., *et al*. "A long term study of fluoride release from metal containing conventional and resin modified glass ionomer cements". *Journal of Oral Rehabilitation* 28.1 (2001): 41-47.
16. Mohan M., *et al*. "Color changes of restorative materials exposed in vitro to cola beverage". *Pediatric Dentistry* 30.4 (2008): 309-316.
17. Hotwani K., *et al*. "Comparative in vitro assessment of color stability of hybrid esthetic restorative materials against various children`s beverages". *Journal of Conservative Dentistry* 17.1 (2014): 70-74.
18. Bagheri R., *et al*. "Influence of food-simulating solutions and surface finish on susceptibility to staining of aesthetic restorative materials". *Journal of Dentistry* 33.5 (2005): 389-398.
19. Lopes LP., *et al*. "Quantification of color variation of restorative materials used in pediatric dentistry after pigmentation". *RGO - Revista Gaúcha de Odontologia* 63.4 (2015): 383-388.
20. Tanthanuch S and Kukiattrakoon B. "Stainability of Esthetic Restorative Materials after Cyclic Immersion in Various Beverages". *Journal of the Dental Association of Thailand* 65.1 (2015): 52-59.
21. Adusumilli H., *et al*. "Color stability of esthetic restorative materials used in pediatric dentistry: An in vitro study". *Journal of the Indian Society of Pedodontics and Preventive Dentistry* 34.3 (2016): 233-237.
22. Gupta R., *et al*. "Spectrophotometric evaluation of color changes of various tooth colored veneering material after exposure to commonly consumed beverages". *Journal of Indian Prosthodontic Society* 5.2 (2005): 72-78.
23. Lee KV., *et al*. "Effect of different beverages on the physical properties of Sonicfill dental composite". *Annals of Dentistry University of Malaya* 22.1 (2017): 30-37.

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