



A SPECTROPHOTOMETRIC EVALUATION OF COLOR STABILITY OF ESTHETIC RESTORATIVE MATERIALS WHEN IMMERSSED IN DEXORANGE AND TURMERIC -AN IN VITRO PILOT STUDY

Dental Science

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ABSTRACT

Background: Color stability of tooth coloured restorative material plays an important role in achieving good esthetic results.
Aim: To evaluate the color stability of GIC, Giomer and Nanohybrid Composites when immersed in distilled water, dexorange and turmeric solution.
Methodology: Totally twenty seven samples, nine each of GIC, Giomer and Nanohybrid Composites were prepared and randomly divided into three groups and immersed in distilled water, dexorange and 0.1% turmeric solution. Pre and post immersion (L,a,b) values were noted and ΔE was calculated.
Results : All the immersion media changed the color of GIC, Giomer and Nanohybrid Resin Composites to varying degrees. However, turmeric solution showed the maximum mean color variation (ΔE ab) in GIC, Giomer and Nanohybrid Resin Composites.
Conclusion: The physical and chemical properties of restorative material and efficacy of staining solutions affect the color stability of the restorative material.

KEYWORDS

color stability, GIC, Giomer ,Nanohybrid Composite, dexorange, turmeric

INTRODUCTION :

A dental restoration or dental filling is a treatment to restore function, integrity and morphology of missing tooth structure resulting from caries or external trauma. There are different types of dental restorative materials, and their characteristics vary according to their intended purpose. Examples include Amalgam, Composite resin, Glass ionomer cement, Resin modified glass ionomer cement (RMGIC), Gionomers and Compomers which fall under the direct restorative materials. Color stability is the ability of a dental material to be able to retain its original color. Color stability of aesthetic dental materials is often ignored over other physical and mechanical properties while making a choice^[1]Hence this article aims at evaluating the color stability of Gic, Giomer and Composite resin.

METHODOLOGY:

Nine samples each of Gic(Fuji IX), Giomer(Beautifil Flow Plus) and resin Composite resin (Herculite Precis) were prepared using a brass mould in a dimension 5 mm × 3 mm. To obtain a flat and smooth surface and to avoid air bubbles, the material was placed in the mould that was sandwiched between two glass plates lined with mylar matrices. It was then cured with LED light for 20 seconds on each side. The tip of the curing unit was placed directly over the glass plate that was 2 mm thick glass slide; thus, the distance between the light source and samples was standardized. The samples were stored in artificial saliva after subjecting to baseline color value assessment using colorimeter (CIE Lab observer-10° illuminant D65, Premier Color scan SS 5100 A, CLRI, Chennai, Tamil Nadu, India). The samples were positioned in the slot against white background in a colorimeter and the baseline L a b values were recorded. Colorimeter measures the amount of light reflected by the selected colors and the color measurements are based on the CIE lab system, developed by Commission Internationale d'Eclairage for characterizing colors based on human perception. A standard illuminant against a white background was used in the present study.^[2]A 0.1% solution of turmeric was made with distilled water. The samples were immersed in distilled water, dexorange and turmeric solution.

GROUPING OF SAMPLES:

Respective samples were agitated for 2 minutes using vortex mixer and were stored in artificial saliva in different containers for rest of the day. This procedure was done three times a day consequently for seven days. On eighth day pellets were removed from artificial saliva and washed with distilled water after which they were brushed for 15 seconds on each side with commercially available soft tooth brush and blotted dry. Pellets were subjected for color estimation on the eighth day and values were noted. An average of three repeated readings was obtained from each sample.^[17] The color difference (ΔE ab) before and after immersion was calculated using the formula $\Delta E ab = ([\Delta L]^2 + [\Delta a]^2 + [\Delta b]^2)^{1/2}$.

Where,

$$\Delta L = L2 - L1$$

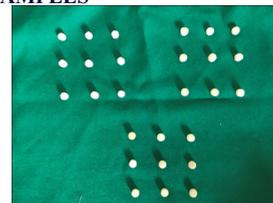
(L1 = pre immersion and L2 = post immersion values in black and white spectrum)

$\Delta a = a2 - a1$ (a1 = pre immersion and a2 = post immersion values in red-green spectrum)

$\Delta b = b2 - b1$ (b1 = pre immersion and b2 = post immersion values in blue-yellow spectrum)

Two-way ANOVA and post hoc Turkey test were done and results were tabulated.

GROUPING OF SAMPLES



STAINING SOLUTIONS



RESULTS:

The Δ E values of GIC when immersed in distilled water, dexorange and turmeric were 1.4±0.22, 3.23±1.6, 4.58±0.267 respectively.

The Δ E values of GIOMER when immersed in distilled water, dexorange and turmeric were 0.58 ± 0.081, 1.52 ± 0.135, 7.23 ± 0.801 respectively.

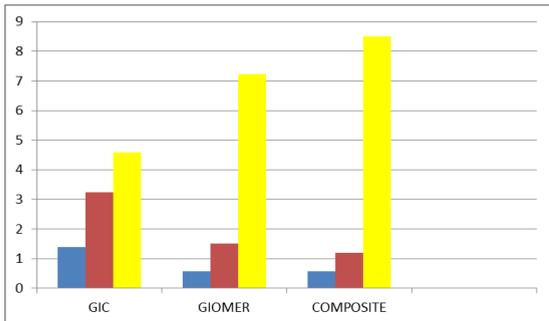
The Δ E values of COMPOSITES when immersed in distilled water, dexorange and turmeric were 0.57 ± 0.056, 1.2 ± 0.532, 8.5 ± 1.89 respectively.

TABLE 1: MEAN VALUES OF ALL THE RESTORATIVE MATERIALS WHEN IMMERSSED IN THREE SOLUTIONS

	Gic	Giomer	Composite
Distilled water	1.4 ± 0.22	0.58 ± 0.081	0.57 ± 0.056
Dexorange	3.23 ± 1.6	1.52 ± 0.135	1.2 ± 0.532
Turmeric	4.58 ± 0.267	7.23 ± 0.801	8.5 ± 1.89

From the above table, composite stained more in turmeric solution when compared to other restorative materials. GIC stained more in dexorange solution when compared to other restorative materials.

GRAPH 1: MEAN VALUES OF ALL THE RESTORATIVE MATERIALS WHEN IMMERSSED IN THREE SOLUTIONS.



DISCUSSION

Color stability is the ability of dental material to be able to retain its original colour. The oral cavity has a dynamic environment. With the continuous presence of micro flora, saliva and frequent intake of coloured food (chromogens), the colour stability of an esthetic material may become compromised.

A variety of esthetic restorative materials are available to restore anterior teeth in pediatric dentistry. These include Glass ionomer cements (GICs), Resin-Modified Glass Ionomer Cements (RMGICs), Polyacid-Modified Resin Composites (PMRCs), Gioners and Composite Resins. GICs are thought to possess cariostatic properties related to their sustained fluoride release and long-term adhesion to tooth structure. However, they are less esthetic than resin-based materials and show poor abrasion and fracture resistance.^[2]

Since esthetics of restorative material is compromised due to oral environment the present study was done with an aim to evaluate the color stability of GIC, Giomer and Composite resins. Nine samples of each restorative material was selected and their color stability was evaluated by immersing them in distilled water, dexorange and turmeric solution. The pre and post immersion values were recorded. The mean ΔE values were calculated.

In the present study, the effect of distilled water on GIC samples were imperceptible to human eye since there were no coloring pigments and clinically acceptable as the mean ΔE value was 1.4±0.22. This was in accordance to **Arwa. M. Ali** who suggested that water sorption itself doesn't cause discoloration.^[3]

The effect of dexorange on GIC samples were moderately perceptible to the human eye as the mean ΔE value was 3.23± 1.6. In the present study, Glass ionomer cement exhibited greater discoloration in dexorange due to Fe³⁺ which is the base metal and also the main ingredient of dexorange syrup.^[4]

When the staining of turmeric on GIC was studied, the color change was found to be moderately perceptible to the human eye as the mean ΔE value was 4.58±0.267. This can be attributed due to the presence of curcumin (oleoresin) in turmeric^[5] and also because of the porosity of the glass particles, as suggested by **A.R Prabhakar et al.**^[6]

Curcumin consists of two aromatic units, each carrying -O-methoxy and phenolic substituents connected by a polyene linker, within which is either a keto-enol or a di-keto moiety. Curcumin may be considered a lipophilic acid dye, somewhat analogous to eosin Y. In addition, the presence of the central di-keto or keto-enol moiety results in ready complexing with metals and pseudo metals such as aluminum or boron respectively, which form the major constituents in GIC.^[16]

In the present study, staining of GIC between those samples immersed in dexorange and turmeric showed no appreciable difference.

Gioners are novel resin-based composites developed from surface-modified pre-reacted glass ionomer cement (SMPRG) technology. Gioners have methacrylate-based resin matrixes similar to resin based composites, with SMRPG fillers instead of traditional quartz and glass fillers^[7] However, water sorption, solubility, and discoloration of giomer have not been thoroughly investigated according to Gonulol.^[8]

The effect of distilled water on Giomer samples were imperceptible to the human eye and clinically acceptable as the mean ΔE value was 0.58±0.081. Higher TEGDMA (triethylene glycol dimethacrylate) content in Giomer caused greater conversion of the resin matrix, decreasing its water sorption and hence decreased susceptibility to staining.^[7]

The effect of dexorange on Giomer samples were imperceptible to the human eye and clinically acceptable as the mean ΔE value was 1.52±0.135. Discoloration of restorative materials is multi-factorial in nature and those factors include degree of resin polymerization, colorant absorption/penetration which explains the staining caused due to dexorange.^[9]

The effect of turmeric on Giomer samples were moderately perceptible and clinically unacceptable as the mean ΔE value was 7.23±0.80. Presence of undissolved glass particle in Giomer results in greater water and food colorant absorption.^[9]

In the present study, staining of Giomer between those samples immersed in dexorange and turmeric showed notable color difference.

The effect of distilled water on composite samples were imperceptible to the human eye as distilled water has no pigments and clinically acceptable as the mean ΔE value was 0.57±0.056. **Arwa. M. Ali** suggested that water sorption itself doesn't cause discoloration. Similar results were obtained in the study conducted by **Debora Soares-Geraldo.**^[12] The effect of dexorange on composite samples were imperceptible to the human eye and clinically acceptable as the mean ΔE value was 1.2±0.532. This could be due to the higher viscosity of Dexorange syrup as stated by **Afzali et al.**^[10]

The effect of turmeric on Composite samples were markedly perceptible to the human eye as the mean ΔE value was 8.5±1.8. Curcumin, the active substance with smaller molecular size present in turmeric imparts yellow colour. Hence, when coupled with the water absorption characteristics of composite, it has created a stronger staining effect. (**Mashalkar et al**^[11], **Prashanti et al**^[12] and **Faiza amin et al**)^[15]

Jyothi chittem stated, turmeric showed maximum staining for composite resins because of natural staining capacity of curcumin.^[13]

Neeraj Malhotra stated that turmeric showed the maximum staining capacity because of difference in particle size and differential solubility of a stain. Other factors involved could be the concentration of the staining solution used, quality of stain or difference in interaction of different stains with different Resin Based Composites.^[14]

Priyadarshini N Bindhal stated that distribution of the nano composite fillers (1 to 10 nm) provides a higher surface area as well as increased interfacial space between the resin matrix and the filler particles. Increased interfacial space, which is considered as the most susceptible area for stain deposition, could subsequently intensify the discoloration of the composite material when compared to micro hybrid composite.^{15]}

In the present study, staining of composite between those samples immersed in dextrorange and turmeric showed decisive color difference.

SUMMARY AND CONCLUSION:

From the present study, it can be concluded that turmeric had higher staining capacity towards composite material and hence it can be used in patients whose diet has less intake of turmeric. The physical and chemical properties of restorative material and efficacy of staining solutions affect the color stability of the restorative material. Within the limits of the study further in vivo studies should be carried out to determine the color stability of Glass Ionomer Cement, Giomer and Composite materials.

Color stability is of great importance to patients and clinicians when working in the esthetic zone. Patients should be aware of their dietary habits if their restorations need to be worn for long period and therefore, may be advised to avoid or minimize consumption of food containing colorants during the service of the composites. The dentist should select and use materials with good color stability, for the excellent serviceability of these restorations.

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