Original Research Paper

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Comparative Evaluation of Effect of Different Mouthwashes on Color Stability of Different Composites –An Invitro Study.

Abstract:

Background: Color is the important property for the restorative materials to have long-term durability in the oral cavity. Color is important in aesthetics, characterizing and personalizing a smile.

Aim: The aim of this study was to evaluate the effects of five commercially available mouthrinses (Listerine, Colgate plax, Clohex Plus, Orahex Plus and Senquel-AD) on color stability of three different resin-based composite restorative materials.

Material and Methods: A custom made stainless steel split mold was used for fabrication of forty-eight samples of each composite resin material (Durafill VS, Z100, Filtek Z350 XT). The samples were immersed in distilled water after curing for 24 hours. Baseline measurements for Color stability were taken. After that, each group was immersed in 20 ml of assigned mouthrinse solutions and incubated at 37° C for 24 hours. The samples were resubjected to Color stability tests. The change in color difference was calculated.

Statistical analysis:

Result: The results revealed that all mouthrinses tested changed the color of the composite resins.

Conclusions: It may be concluded that the effect was both mouthrinse and material dependent.

Key-words: - Composite resins, Mouthrinses, Color stability

Introduction:

Today, number of people using mouthrinse solutions for anti-microbial control. These solutions have various components such as detergents, emulsifiers, organic acids, dyes and alcohol that can lead to the degradation of the composite resin surface.[3]

Factor that affects the clinical longevity of anterior restorations is the unacceptable color match. The color change of composite resin restorations is multifactorial associated with intrinsic discoloration and extrinsic staining.

Several types of composite resins with different physical and mechanical characteristics are available in the dental market. Among the most widely used composites are the microfill and hybrid type. By the introduction of nanotechnology in dentistry, nanocomposites with nanometer-sized filler particles have been developed.

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[1]PARUL AHUJA, [2]VARUN AHUJA, [3]NEETU JINDAL, 4RENU AGGARWAL, 5UMESH KASWAN

[1,3,4]Department Conservative Dentistry & Endodontics College, Suendera Dental College & Research Institute

2Department Orthodontics and Dentofacial Orthopaedics College- Suendera Dental College & Research Institute

[5]Department- Oral and Maxillofacial surgery College, Pacific Dental College

Address for Correspondence: Dr. Varun Ahuja
Senior Lecturer
Department- Orthodontics and Dentofacial Orthopaedics College, Suendera Dental College & Research Institute
Email : shanahuja@live.com

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So the aim of this in-vitro study is to examine the effects of commercially-available mouthrinses on color stability of composite resins.

Methodology Materials:

Three types of composite resins were used in the present study. The material brand name, types, composition, shade, batch number and name of manufacturer are given in Table 1. Five types of commercially available mouthrinses with different types, composition and manufacturer are given in Table 2.

Table 1: The brand name, types, composition, shade, batch number and manufacturer of composite resins.

Material brand name	Type	Composition	Shade	Batch no	Manufacturer
Durafill VS	Microfilled Composite	Bis-GMA/TEGDMA, UDMA silicon dioxide (0.020.07 µm) Splinter polymer (< 20 µm), Inorganic and organic filler make up to 66% volume	A3	010218	Heraeus Kulzer Gmbh Gruner Weg 11, 63450 Hanau(Germany)
Z100	Hybrid Composite	Bis-GMA, TEGDMA, 66% silica/ zirconia Filler particle size 0.0-8.5 µm	A3	N172696	3M ESPE DentalProducts, St Paul, MN 551441000 USA
Filtek Z350 XT	Nano Composite	Bis-GMA, Bis-EMA, PEGDMA, UDMA, TEGDMA and 20 nm silica filler/ zirconia/ silica particles zirconia/silica Cluster filler The inorganic filler loading 55.6% by volume	A3	N425904	3M ESPE Dental Products, St Paul, MN 551441000 USA

Table 2: The brand name, types, composition, batch number and manufacturer of mouthrinses.

Material brand name	Types	Composition	Batch no.	Manufacturer
Listerine	Alcohol based	Purified water,Sorbitol, Alcohol 21.6%, Poloxamer407, Benzoic Acid, Sodium Saccharin, Eucalyptol 0.092%, Flavour, Methyl Salicylate 0.060%, Thymol 0.064%, Sodium Benzoate, Menthol 0.042% CI 42053	BN 2013	Johnson and Johnson Tumkur Road, Ŧ Begur Bengalore
Colgate Plax	Alcohol and fluoride containing	Glycerin, Ethyl Alcohol 7.3%%, Sorbitol, Propylene Glycol, Polysorbate 20, Sodium benzoate, Sodium Fluoride, 0.05% Cetylpyridium Chloride , Sodium Saccharin, Brilliant Blue	B130127	Colgate Palmolive India Hiranandani gardens, powai Mumbai
Clohex Plus	Aqueous based and fluoride containing	Chlorhexidine Gluconate 0.20%, Sodium Fluoride 0.05%, Zinc Chloride 0.09%	BCP4039	Dr. Reddy's Laboratories Amarpreet, Hyderabad
Orahex plus	Aqueous based and fluoride containing	Chlorhexidine Gluconate 0.20%, Sodium Fluoride 0.05%, Zinc Chloride 0.05%	E-939	Abbott pharma Pharmacity, Dehradun
SenquelAD	Aqueous based and fluoride containing	3% Potassium Nitrate, Sodium Fluoride 0.2%	BSD 3018	Dr. Reddy's Labratories Amarpreet, Hyderabad

Methodology:

A custom made stainless steel split mold was used for fabrication of samples, which was 10 mm in diameter and 2 mm in height. One hundred forty four disc -shaped samples of resin based composites were prepared. The mold was placed on glass-slab and filled with resin composite to a slight excess using teflon coated instrument covered with a clear matrix strip and another glass slide was placed on top and gently pressed for 30 s to extrude excess material to obtain a smooth surface. Each samples was cured for 20 seconds from the top and another 20 seconds from the bottom using Mini LED, Auto focus 2 [Satelac] of wavelength in the range of 420-480nm. The samples were polished with # 600-grit sandpaper. The thickness of every samples was checked by Digital Caliper.

1) Grouping of samples for baseline measurements:

A total of One hundred forty four samples were fabricated for Color stability measurement. For baseline measurements, these samples were divided into three main groups. Each group contained forty eight samples of three different composite resins. The samples were immersed in 20 ml of distilled water for 24 hr and blotted dry by using filter paper.

Base line measurements for Color stability was assessed using Colorimeter (HP-200) (Shenzhen Handsome Technology Co. Ltd). Colorimetric values of the samples were determined using the L* a* b* system of the Commission Internationale de l'Eclairage (CIE L* a* b* color scale). The results obtained were considered baseline records for each samples.

2) Immersion of Samples in the experimental solutions

The samples were immersed in 20ml of mouthrinse solutions and in distilled water contained in different petridishes and incubated at 37ºC for 24hr. The pH of used solutions were measured before and after of immersion using digital pH meter.

3) Measurements of color stability

All samples were removed after 24 hours from incubator. Each sample was rinsed thoroughly with distilled water for 120 seconds. Each sample was then blotted dry using a filter paper and subjected to measurements of Color stability.

The color stability was assessed by using Colorimeter (HP-200) (Shenzhen Handsome Technology Co., Ltd). For the color assessment, each specimen was subjected to color measurement in the same way as the baseline. The color difference ΔE* was calculated for each sample using the following equation : ΔE*=[(ΔL*)2+(Δa*)2+(Δb*)2]1/2

The recorded data for color assessment were collected and statistically analyzed.

Result:

Order of composite resins according to maximum change in color stability values:

Filtek Z350 XT (Group C) > Durafill VS (Group A) > Z100 (Group B)

Filtek Z350XT (Group C) contains UDMA and Bis-EMA resinous matrix. Both are hydrophobic in nature so didn't allow absorption of mouthrinse solutions. So this composition showed higher color stability.

Order of mouthrinse solutions according to maximum change in color stability (Δ E)

Senquel –AD > Clohex Plus > Orahex Plus > Colgate Plax > Listerine > Distilled Water

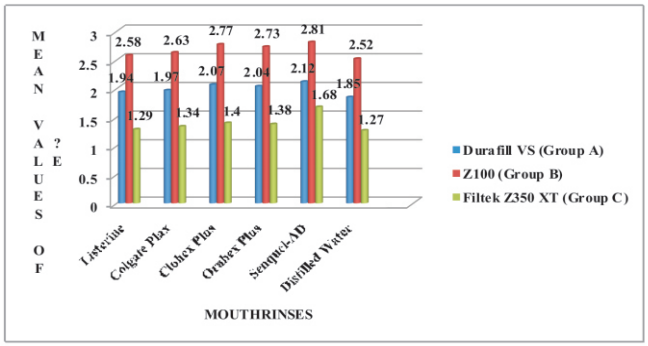
Senquel-AD mouthrinse showed greatest color change this may be due to percentage of sodium fluoride (0.2%).

If we compare the mean value and standard deviation values for all three composite resins for color stability (ΔE) after
immersion in different mouthrinses, the results were material dependent as given in Table 3 and Graph 1.

Table 5: Intergroup comparison of mean and standard deviation of color stability

Groups Material → / Mouthrinses ↓	Durafill VS (Group A) MEAN (±)SD	Z100 (Group B) MEAN (±)SD	Z Filtek 350 XT MEAN (±)SD
Listerine	1.94 ±0.53	2.58±0.17	1.29±0.25
Colgate Plax	1.97 ±0.58	2.63±0.34	1.34±0.26
Clohex Plus	2.07 ±0.49	2.77±0.19	1.40±0.41
Orahex Plus	2.04 ±0.66	2.73±0.17	1.38±0.51
Senquel-AD	2.12 ±0.44	2.81±0.2	1.68±0.32
Distilled Water	1.85 ±0.61	2.52±0.23	1.27±0.22

Graph 2: Mean comparison of color stability (ΔE) of different composite resins after immersion in different mouthrinses solutions.



In intergroup comparison of different composite resins for reduction in color stability (Δ E) after immersing in different mouthrinse solutions using one way ANOVA showed very highly significant (P<.0001) and post hoc Tukey's HSD test showed highly significant (P<.01) results.

In intergroup comparison of different mouthrinses One Way ANOVA Test and post hoc Tukey's HSD test for color stability (Δ E) showed no statistically significant (>.05) difference between the mouthrinses and distilled water for same composite resin.

Discussion:

Color stability of different composite resins after immersion in different mouthrinse solutions for 24hr

The results of the present study revealed that, all mouthrinses affects the color stability of tested composite resins. Color stability was affected due to fluoride content in mouthrinses.

Composite structure and characterstics of the inorganic fillers have a direct impact on composite resin surface and susceptibility to extrinsic staining.[3] The resin matrix used in the materials has also shown to play an important role in staining susceptibility.[16] The affinity of the resin matrix for stains is modulated by its conversion degree and by some physical properties, such as water sorption. Water sorption of composite resins depends on the resinous matrix composition. It has been reported that water uptake in Bis-GMA based composite resins increased from 3 to 6% as the proportion of TEGDMA increased from 0 to 1%.[3] Bis-GMA and TEGDMA are hydrophilic monomers and UDMA and Bis-EMA are hydrophobic monomers. Against this background, the stain resistance capability might be attributed to a low water sorption rate stemming from the use of hydrophobic resin system i.e. UDMA and Bis -EMA.[17]

Senquel-AD mouthrinse showed greatest color change, this may be due to percentage of sodium fluoride (0.2%). Study done by Diab et al. showed that greatest perceptible color change was observed in composite resins after using sodium fluoride containing mouthrinse (Flucal).[2]

Listerine used in this study did not contain sodium fluoride, that's why showed maximum color stability values.

Filtek Z350XT (Group C) contains filler particle size ranging from 4 to 11nm. It contains UDMA and Bis-EMA resinous matrix. Both are hydrophobic in nature so didn't allow absorption of mouthrinse solutions.[17] So this composition showed higher color stability in present study.

On other hand studies have shown that filler particles are responsible for spreading the light. Smaller the filler particle size lesser will be spread of light, resulting less opacity and more color stability.[3]

When we compare Group A (Durafill VS) it shows less color stability as compare to Group C (Filtek Z 350XT) because it contains larger filler particle size i.e. 0.02- 0.07µm than Group C. Durafill VS contains Bis-GMA/TEGDMA and UDMA in resinous matrix. UDMA resists water sorption. The results of Durafill VS in Comparison to Z350 XT were dependent on particle size. As it has larger particle size, So spread of light was more which leads to more opacity.[3]

In inter group comparison of all the groups Z100 (Group B) showed less color stability than all other groups (Table 5 and Graph 2). Because the particle size of Z100 is 0.01-3.5µm [3], which is larger than other groups. It contains Bis-GMA and TEGDMA resinous matrix as Bis-GMA is hydrophilic in nature, so it allows more water sorption, which leads to less color stability.

One Way ANOVA Test and Post hoc HSD test showed very highly significant ($p < .0001$) difference for all composite resin groups after immersion in all mouthrinse solutions.

There was no statistically significant ($P>0.5$) difference between the mouthrinses and distilled water for same composite resin.

Conclusion- With in the limitation of this invitro study we can conclude that, all mouthrinses tested in this study affected the microhardness and color stability of the tested composite-resins, but the affect was both mouthrinse and material dependent.

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