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Expert Opinion Article

# Evaluation Of Staining Susceptibility Of Aesthetic Restorations Following Mouthrinses – An In Vitro Study

**Jayanthi Govindarajan[1], Poorani Durai[2*], Karthikeyan Arumugam[3], Harish Ramalingam[4], Shasidharan. P[5], Rahul Chaurasia. M[6]**

[1]MDS, Ph.D Scholar - Indira Gandhi Institute of Dental sciences, Sri Balaji Vidhyapeeth, (Deemed to be University) Assistant Professor - Department of Conservative Dentistry and Endodontics, Madha dental college and hospital, Kundrathur , Chennai- 600029, Email address: gjayanthi13@gmail.com, ORCID Id: 0009-0007-9392-8551

[2]*MDS, Ph.D Scholar - Indira Gandhi Institute of Dental sciences, Sri Balaji Vidhyapeeth, (Deemed to be University) Assistant Professor - Department of Conservative Dentistry and Endodontics, Sri Venkateshwaraa Dental college, Ariyur, Puducherry. Email address: pooranidurai007@gmail.com ,ORCID Id: 0009-0009-0544-8430.

[3]MDS, Associate Professor, Department of Conservative Dentistry and Endodontics, Sri Venkateshwaraa Dental college, Ariyur, Puducherry, Email address: dr.akarthikeyan@gmail.com, ORCID Id: 0000-0002-5001-553X

[4]BDS, Post graduate student, Department of Conservative Dentistry and Endodontics, Sri Venkateshwaraa Dental college, Ariyur, Puducherry, Email address: harishr2899@gmail.com, ORCID Id: 0009-0000-3631-4739

[5]MDS, Assistant Professor Department of Conservative Dentistry and Endodontics, Sri Venkateshwaraa Dental college, Ariyur, Puducherry, Email address: drshasidharan25@gmail.com, ORCID Id: 0009-0000-4886-4543

[6]MDS, Assistant Professor, Department of Conservative Dentistry and Endodontics, Sri Venkateshwaraa Dental college, Ariyur, Puducherry, Email address: rkc456@gmail.com, ORCID Id: 0009-0004-1099-6558

***Corresponding Author:** Poorani Durai

*MDS, Ph.D Scholar - Indira Gandhi Institute of Dental sciences, Sri Balaji Vidhyapeeth, (Deemed to be University) Assistant Professor - Department of Conservative Dentistry and Endodontics, Sri Venkateshwaraa Dental college, Ariyur, Puducherry. Email address: pooranidurai007@gmail.com, ORCID Id: 0009-0009-0544-8430

**ABSTRACT**

**AIM:** The purpose of this study is to determine the staining susceptibility of nano-filled composite materials following the use of two different mouth rinses.

**METHODS AND MATERIALS:** The study sample consists of two different nanocomposites of shade A2. 30 samples of nano-filled composites (15 each) with a diameter of 8 mm and thickness of 2mm will be prepared using a metal ring. The samples will be divided into two groups: GROUP A (Tetric N-Ceram), GROUP B (3M ESPE Filtek). Each group has 5 subgroups: Subgroup A: control (normal water), Subgroup B: Betadine 2 % Mint Gargle, Subgroup C: Colgate Plax, Subgroup D: Hexidine, Subgroup E: Peroxyl. All the samples will be immersed in respective mouth rinses for the respective period, then the samples will be placed in distilled water after the testing period and the procedure will be carried out for one week. The color stability differences between the nanocomposites while using two different mouth rinses will be measured by spectrophotometer. Data will be analyzed by ANOVA test.

**RESULTS:** The color difference (ΔE*) of the resin materials ranged between 5.46000 and 0.58400 after one week of assessment.

**CONCLUSION:** Tetric N-Ceram has more staining susceptibility than 3M-ESPE nano-composites. Among the different mouth rinses, betadine has more staining potential followed by Colgate Plax, CHX, and Hydrogen peroxide.

**KEYWORDS:** Tetric N-Ceram, 3M ESPE Filtek, Mouth rinses

## INTRODUCTION:

For today's rising aesthetic standards, the most important long-term success requirements for restorative dentistry are colour harmony and stability between teeth and restorations. Even materials that have a colour harmony with tooth can show discoloration owing to external or internal influence [1]. Internal elements that affect colour stability come from a material's structure, and include things like amine accelerator oxidation, which is necessary for polymerization but increases liquid absorption. External influences include liquid and solid foods taken on a regular basis, as well as systemic conditions, dietary and dental hygiene habits, and restorative surface roughness[2].

Discoloration of teeth and restorations can also be caused by mouthwashes. Chlorhexidine gluconate, ethanol, essential oils, and detergents are common ingredients in oral mouthwashes. It can harm soft tissues and oral flora, cause a transient loss of taste sensation, and degrade the surface qualities of restorations if used frequently [3].

Because of their aesthetics and mechanical qualities, nanofilled resin composites have grown increasingly popular in recent years [4]. Nano composites have a number of benefits over traditional glass fibre

composite resins. The surface is smooth. Because of its nanoscale size, the nanocomposite has a significantly better polish than the glass fibre composite [5].

Tetric N-Ceram Bulk Fill (Ivoclar Vivadent) was introduced with the claim that it could replace both nonflowable and bulk-fill flowable composites that required a 2 mm increase when employing the incremental layering procedure. This composite will accomplish full-depth bulk fill up to 4 mm without a superficial capping layer. Tetric® N-Ceram Bulk Fill contains a shrinkage stress reliever, to reduce polymerization shrinkage. However, there is little information on the composites colour stability, particularly when immersed in mouth rinses [6].

Filtek Z350 XT Universal Restorative is a visible light-activated composite. It has exceptional esthetics, excellent adaptation, excellent polish retention exceptional handling, and outstanding strength for anterior and posterior excellent wear resistance.

In this study, 3M ESPE Filtek (3M ESPE) and Tetric N-Ceram nano-composites were tested for the susceptibility to tooth discoloration after using 5 different mouth rinses.

## MATERIALS AND METHODS:

### Preparation of specimens

Two different nano-filled composites were used. All the materials selected for the study were of shade A2, as it is the most commonly used shade [7].

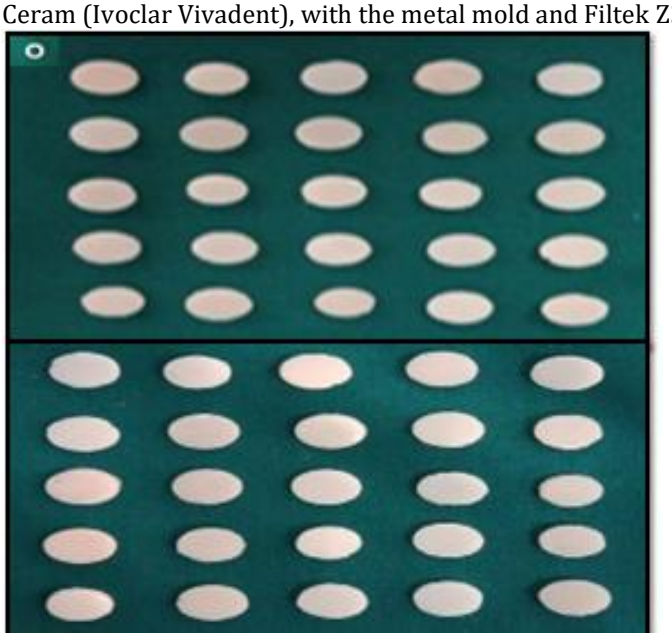
**Figure 1**: G Tetric N-Ceram (Ivoclar Vivadent), and Filtek Z350XT (3M ESPE).


**Composition OF Tetric N-Ceram AND Filtek Z350XT**

| Material (Manufacturer) | Composition |
|---|---|
| Tetric N-Ceram (Ivoclar Vivadent | Dimethacrylates, additives, catalysts, stabilizer sand pigments, barium glass, ytterbium trifluoride, mixed oxide and prepolymerized filler (prepolymers) (56% vol.)[8] |
| Filtek Z350XT (3M ESPE), | Bis-GMA, UDMA, TEGDMA, PEGDMA, and Bis-EMA, Silica; Zirconia; Clusters of particles aggregate of silica/zirconia[7] |

50 disc-shaped specimens were prepared from two different resin composites including Tetric N- Ceram (Ivoclar Vivadent) (n= 25) and Filtek Z350XT (3M ESPE) (n= 25).Then the samples were divided into two groups: Group A: Tetric N-Ceram (Ivoclar Vivadent), Group B: Filtek Z350XT (3M ESPE). The specimens were 8 mm in diameter and 2 mm in thickness and were fabricated using a cylindrical stainless steel mold. Materials were loaded into the molds and pressed between two glass slides lined with polyester film (Mylar Strip, SS White Co., Philadelphia, PA, USA). The top surfaces of all specimens were polymerized for 20 seconds using a standard LED light curing unit (Elipar S10, 3M ESPE) with a minimum output of 1,200 mW/cm2.

**Figure 2**: Tetric N Ceram (Ivoclar Vivadent), with the metal mold and Filtek Z350XT (3M ESPE)



Then the 50 discs of each group were divided into 5 subgroups (n= 10 each) that were submerged in the following mouth rinses, Subgroup A: control (Saline), Subgroup B: Betadine 2 % Mint Gargle, Subgroup C: Colgate Plax, Subgroup D: Hexidine, Subgroup E: Peroxyl.

**Figure 3: a: Control (Saline), b: Betadine 2 % Mint Gargle, c: Colgate Plax, d: Hexidine, E: Peroxyl and the samples were immersed in the respective solutions**


All the samples were immersed in respective mouth rinses for respective time period as mentioned in the mouthwashes of about 30 seconds. The samples were placed in distilled water after the testing time period and the procedure was carried out for one week. The color stability differences between the nano composites while using the four different mouth rinses were measured by spectrophotometer.

The values were taken from each specimen's central section using a CIE-Lab (Commission internationale de l'Eclairage L*, a*, b*) colour space spectrophotometer after the specimens were processed. Before measuring spectrophotometric data, the instrument was calibrated using white and green standards found in the rechargeable base. The L*, a* and b* values were measured and they were used to calculate the ΔE.

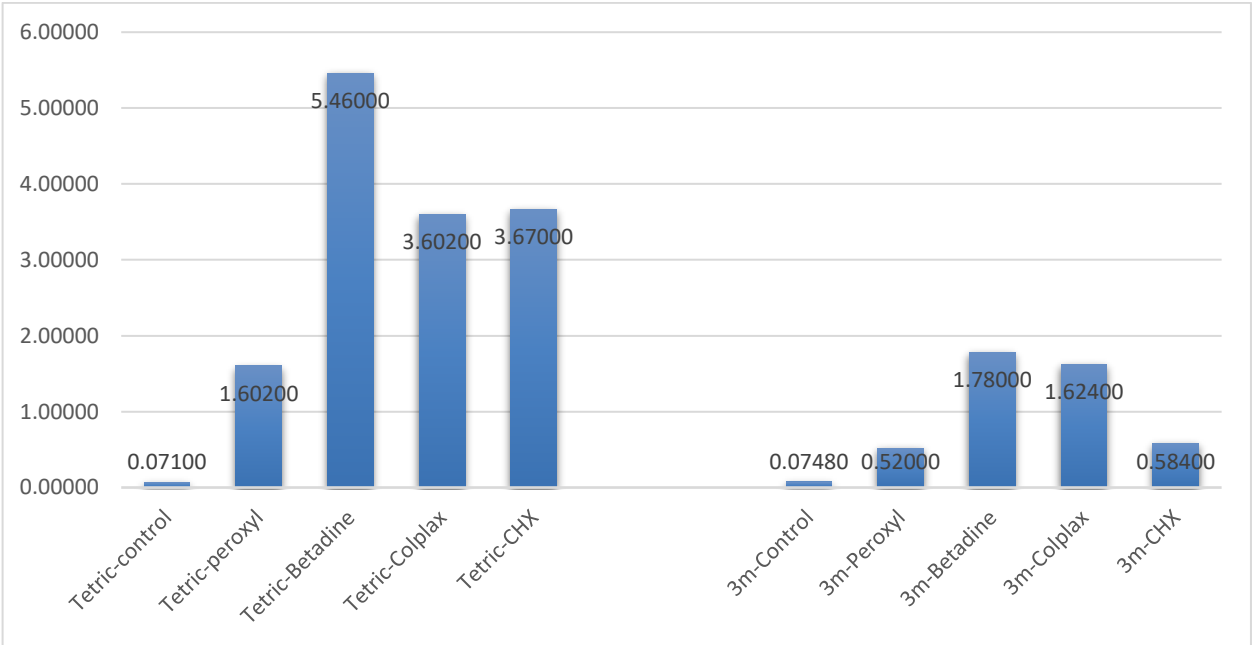
**Statistical analysis:**
Statistical analysis of the data was done using IBM. SPSS Version 26 software package. Descriptive statistics including mean and standard deviation were calculated for various parameters. Shapiro-Wilk test was used to assess the normality of the data. Further analysis was done using non-parametric tests since the data significantly deviated from normal distribution. Overall comparison of the Delta e values between the groups was done using Kruskal - Wallis test. The mean rank differences between two independent groups were compared using Mann-Whitney test. The level of significance in the present study was kept at $p<0.05$.

**TABLE 1: DESCRIPTIVE VALUES FOR ΔE**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Tetric-control | 5 | .07100 | .001581 |
| Tetric-peroxyl | 5 | 1.60200 | .019235 |
| Tetric-Betadine | 5 | 5.46000 | .015811 |
| Tetric-Colplax | 5 | 3.60200 | .019235 |
| Tetric-CHX | 5 | 3.67000 | .015811 |
| 3m-Control | 5 | .07480 | .001924 |
| 3m-Peroxyl | 5 | .52000 | .015811 |
| 3m-Betadine | 5 | 1.78000 | .015811 |
| 3m-Colplax | 5 | 1.62400 | .020736 |
| 3m-CHX | 5 | .58400 | .011402 |
| Total | 50 | 1.89878 | 1.726072 |

**TABLE 1**: shows the descriptive values for delta E among the two different nanocomposites following the use of five mouth rinses.

**GRAPH 1: ΔE VALUES AMONG THE STUDY GROUPS**




**GRAPH 1:** shows higher ΔE values for Tetric N- ceram following the betadine mouth rinse. And lower ΔE values were found in Filtek Z350XT (3M ESPE) following peroxyl mouthrinse.

**RESULT:**
After one week, When compared to Filtek Z350XT (3M ESPE), the results showed that Tetric N Ceram was the most vulnerable to staining, with a high mean range of ΔE = 5.46000. Betadine mouthrinse had the best staining ability, followed by Colgate Plax, chlorhexidine, and peroxyl in Tetric N-Ceram In Filtek Z350XT (3M ESPE), Betadine mouth rinse has the best staining ability followed by Colgate Plax, Chlorhexidine, and Peroxyl.

**DISCUSSION:**
In this study, Instrumental colorimetry was used because it has the ability to remove subjective colour

judgement errors, according to Anusavice et al. Colorimetry and spectrophotometry are two instrumented colour measurement techniques that have been reported to be reliable in dental material studies [9]. The CIE L*a*b* colour system, which was employed in this study, is a method that is recommended for dental use. It classifies colours using human perception. L*, a*, and b* are the three spatial coordinates used to designate it. The brightness (value) of a shade is represented by L*, the quantity of red-green colour is represented by a*, and the amount of yellow-blue colour is represented by b*. The colour change is determined as ΔE, using absolute measurements in L*a*b* colour parameters. If a material is totally colour stable, there will be no colour difference after it has been exposed to the testing environment (E* = 0) [10].

The staining susceptibility of composite resins is mainly based on their degree of water sorption and the hydrophilic nature of the matrix resin, so if the composite resins can absorb water then it can also absorb other fluids and resulting in discoloration. The glass filler particles cannot absorb water, but it can adsorb water onto the surface, which is dependent on the resin content of the composite and also on the quality of the bond between the resin and the filler [11].

In this study, Tetric N Ceram was most susceptible to staining when compared with Filtek Z350XT (3M ESPE). Among the mouth rinses used, Betadine has more staining ability in Tetric N-Ceram and also In Filtek Z350XT (3M ESPE). This was in contrast to this study by Roselino et al. the study stated that the TEGDMA present in Filtek Z350 XT may have favored water sorption and increased the solubility of the polymers [12].

Limitations of this study are the oral environment cannot be replicated in the laboratory and restorative materials are never exposed to staining medias for such a lengthy period of time, it is impossible to establish an accurate correlation between in vitro and in vivo studies [13].

Finally, understanding the composition of the restorative material, polymerization cycle and promoting adequate surface texture, is critical in order to select the appropriate material for each clinical application and use it competently to achieve its best properties, ensuring longevity and success.

**CONCLUSION:**

Within the limitations of this study, Betadine mouthrinse has more staining ability among the other mouthrinses and Tetric N-Ceram was more susceptible to staining when compared with Filtek Z350XT.

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