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Color Stability of Composite and Ceramic Veneers over a period of 1 year

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Abstract

Color stability of any material is affected by two factors- namely intrinsic and extrinsic. For dental ceramics, amongst the various factors, the variables in the control of the operator include the glaze layer, the diet of the patient and oral hygiene aids.The aim of the study is to evaluate the effect of different staining solutions on ceramic restorations based on the glaze layer.A pictorial survey was carried out amongst 100 dentists evaluating the outcomes of composite veneers v/s ceramic veneers. This was followed by an in-vitro evaluation of the color stability of composite discs (z350xt) and ceramic discs (CEREC and Emax) after placing in 4 solutions. Finally, an in-vivo evaluation of the color stability of the restorations– Composite and Ceramic veneers was done with a 1 year follow up period. The highest ΔE values in the CEREC CAD and IPS Emax CAD group was observed in the group where the glazed, trimmed, polished discs were exposed to the turmeric solution. The b value of the composite samples significantly increased over 1 year in the in-vitro and the in-vivo observation. Color stability of composite veneers is lower than ceramic veneers (ΔE <3.7). However, it is clinically acceptable at 1. The color stability of highly polished nano-clustered composite resin shows comparable results to ceramic veneers, but needs regular maintenance.

Keywords: Porcelain, Staining, Glazing, Polishing

I. INTRODUCTION

Color stability of any material is affected by two types of factors- namely intrinsic and extrinsic factors. The intrinsic factors include on the composition of the material, surface roughness and the structural properties and the extrinsic factors include the environmental factors (Bayne, 2005). Similarly, in ceramics, the intrinsic factors include the ceramic composition, the superficial glaze layer composition and thickness, and in composites, the intrinsic factors include the composition and fillers particle size and content for polishability and strength .(Nicholson & Czarnecka, 2016) The extrinsic factors include the diet of the patient, the mouthwash solutions etc . Of these factors, the variables in the control of the operator include the glaze layer in cases of ceramic and the finishing-polishing of the composite. (Celik et al., 2008)The diet of the patient and oral hygiene practices are patient dependent variables. The aim of the study is to evaluate

1. Preference of dentist for outcomes of smile designing -composite veneers v/s ceramic veneers
2. In-vitro evaluation of the color stability of composite discs (Z350XT), ceramic discs (CEREC and Emax)
3. In-vivo, color stability of the restorations– Composite and Ceramic veneers.

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II. MATERIALS AND METHODS:

The research proposal was divided into 3 parts

1. A pictorial survey was conducted amongst 100 dentist evaluating the outcomes of composite veneers v/s ceramic veneers.
2. In-vitro evaluation of the color stability of composite discs (z350xt), ceramic discs(CEREC and Emax) after placing in 4 solutions
3. In-vivo, color stability of the restorations– Composite and Ceramic veneers at 1 year follow up

The pictorial survey consisted of a series of questions along with pictures demonstrating various outcomes of ceramic and composite veneer restorations. The survey was carried out amongst 100 dentist students or dentists studying in Saveetha Dental College and Hospital.

In the second phase, an in-vitro study was carried out using ceramic and composite discs. Square specimens (10×10×2 mm) were fabricated in 9 groups: IPS Emax CAD HTA2/I 12- A) Glazed B) Glazed and roughened by bur C) Glazed, roughened by bur and reglazed ; and CEREC CAD group A2 - A) Glazed B) Glazed and roughened by bur C) Glazed, roughened by bur and reglazed. Thin discs of 3M ESPE Z350XT composite were made of 2mm thickness and stabilized on stand. The discs were divided into 3 groups A) Fresh discs just light cured B) Disc cured and dry polishing done C) Discs cured and wet polishing done. Thin discs cut out of IPS Emax CAD, CEREC CAD blocks and Z350xt composite discs and digital calipers were used to measure and verify the thickness of all specimens. They were divided into three groups as mentioned above. Each group was divided into 4 subgroups, depending on the staining solution- Distilled water[D],Turmeric [T]; coffee [C]; Black tea [BT]). Staining liquids were prepared at 30 % by vol concentration once and the same solution was used for all the groups. 5 discs were placed in each group. The color determination was carried out using a spectrophotometer (Easyshade Advance 4.0, Vita). Color changes were examined using the CIELab color system.

Inclusion criteria: Patients desiring esthetic correction

Exclusion criteria: Patients indicated for full coverage restoration

5 Patients were included in each of the categories. Patients were treated with either ceramic or composite veneers for the teeth indicated. Spectrophotometric evaluation was made at 3 regions – cervical, middle and incisal region of each tooth to be treated (Fig 1). The L,a,b values were noted. The patients were recalled for a follow up every 3 months. The spectrophotometric evaluation was done at the end of 1 year as a part of a protocol for all esthetic restorations(Fig 2). The ΔE values were calculated using the following formula.

$$\Delta E = \sqrt{(L_1 - L_2)^2 + (a_1 - a_2)^2 + (b_1 - b_2)^2}$$

Fig 1: Shows the spectrophotometer evaluation.

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Fig 2: Showing the ΔE values at 0 and 1 year interval.

III. RESULTS:

The survey results showed that 64% dentists preferred ceramic restorations over composite. The survey result explained the reason to be longevity(59%) and esthetics(62%) majorly. The highest DE values in the CEREC groups was observed where the ceramic was glazed trimmed and then polished, in the turmeric group [4.43], black coffee [4.37], black tea [4.22], which showed statistically significant difference from each other [P < 0.001]. The highest DE values in the IPS Emax groups was observed where the ceramic was glazed trimmed and then polished, in the turmeric group [4.54], black coffee [3.45], black tea [3.63]. On further analysis, the ceramic showed increase in yellowish color and decrease in lightness.

The maximum change in the L,a,b values was seen for the Z350xt group. The b value of the composite samples significantly increased over 1 year in the in-vitro and the in-vivo observation. However the inter-proximal and cervical areas of the composite veneers needed to be polished in 2 cases. Color stability of composite veneers is lower than ceramic veneers (ΔE <3.7). However, it is clinically acceptable at 1 year

	N	Mean	Std. Deviation
Emax Veneers	20	1.0700	.06061
CEREC Veneers	20	1.2585	.09461
Z350xt Composite Veneers	20	3.3330	.43782

Table 1: Represents the mean and standard deviation of the ΔE values at the end of 1 year

Discussion:

As per the results displayed in the poster, we can appreciate that the composite discs were more susceptible to color changes compared to ceramic discs. This is a well known fact and is well documented in literature too (Hotwani et al., 2014). However, with the development in the field of composite resins, nanohybrid composites have brought significant improvement in the strength and the surface finish (Hopp & Land, 2013). The development in the filler particles put forth a significant question about the potential comparison to ceramic restorations. The results of the study showed that Z350xt composite, which contains nanoclusters showed significant color stability in highly polished states. This is owing to the property of the nanoclusters which reduce the interstitial spaces of the filler particles and increase the filler load which improves the wear (Kara et al., 2011) . Highly polished composite restorations have minimal interstitial spaces. Wet polishing helps in reducing the debris clutter and ensures a smooth surface . The same results were verified in a clinical scenario to evaluate the effect of the patient`s diet and the intraoral conditions on the restorations.(Fasbinder et al., 2010)

Previous studies showed that common beverages like red wine, tea, and coffee cause the most significant color changes of composite resins and dental

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porcelains (Guler et al., 2005). However, in India the most commonly consumed spice is turmeric Nevertheless, it was noted that these types of beverage only affect the external surface of specimens [external staining], and their effects on the internal structure must be further evaluated . Hence, color stability is affected by the surface texture of the material(Koishi et al., 2008).

The clinical cases restored using composite and ceramic veneers were evaluated after 1 year. The results showed that composite restorations showed mild changes in the colour detected by the spectrophotometer, however, they were clinically acceptable. Long term studies are recommended for the same to improve the external validity.

IV. CONCLUSION:

Well polished nano-clustered composite resin shows comparable results to ceramic veneers, but need regular maintenance. Most dentist preferred ceramic restorations for smile designing based on their comfort and esthetic outcome. Turmeric, which is the most commonly used spice in the Indian diet causes the highest changes in the ΔE values for the restorations. The color stability of highly polished nano-clustered composite resin shows comparable results to ceramic veneers, but needs regular maintenance.

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