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## Clinical Evaluation of Color Stability of Direct Composite Resin Veneers in Vital Anterior Teeth

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**Aim:** to evaluate the color stability of direct composite resin veneers over an 18-month evaluation periods in vital anterior teeth. **Materials & Methods:** The studied samples consisted of 88 discolored vital anterior teeth in 20 patients aged between 18–40 years, these cases were divided into two groups: Group 1: OMNICHROMA (single shade) supra nano filled composite, and Group 2: Ceram. x spectra (multi-shade) nanohybrid composite. Window preparations of veneers were made to a depth of 0.3–0.5 mm on the labial surface of vital anterior teeth. Color change assessment ( $\Delta E$ ) were performed with a spectrophotometer VITA Easyshade V according to CIELab color coordinates by two calibrated investigators at baseline, 6, 9, 12 and 18 months follow up period. **Results:** One way ANOVA showed that there was highly statistical significant difference between color change values at different evaluation periods for each group I (F=15.8, P-value=0.000) and group II (F=16.68, P-value=0.000). Multiple comparisons Tukey's test revealed a statistically highly significant difference between the results of baseline, 6 and 9 months versus both 12 & 18 months follow up periods for each group I and II (P-value = 0.000). The independent t-test revealed that there was no statistical significant differences between both groups except at baseline and 12 months follow up period where P-value recorded 0.025 and 0.023 respectively.

**Conclusion:** Single and multi-shade composite veneers have comparable acceptable clinical performance regarding the color stability after 18 months follow up.

Keywords: Color Stability, Composite, Veneers, Clinical, Single Shade.

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#### Introduction

Esthetic in dental practice has become crucial in modern restorative dentistry. Color and shape are mainly dictated the esthetics of both restored and natural teeth. Over the last decades, there has been a tremendous improvement in the importance of color research in dental science.<sup>1</sup> In order to provide esthetic dental restoration; the dentist should take into account the artistic aspects of color matching and understanding of the chromatic aspects of natural teeth and optical properties such as translucency, opalescence, fluorescence and counter-opalescence.<sup>2</sup>

Patients may experience severe aesthetic problems if there are abnormalities in the anterior teeth's color, shape, structure, or position. Patients' desire for esthetic dentistry procedures has directly led to the development of techniques intended to restore the natural appearance of their teeth.<sup>3</sup> Discolored vital anterior teeth are frequently considered as an esthetic problem in today's world of cosmetic dentistry.<sup>4</sup>

Veneer restorations for vital anterior teeth have gained a lot of attention nowadays, due to the increasing desire for more gorgeous attractive smiles and white teeth with minimally invasive teeth preparation. Owing to the growing significance of aesthetic appearance, studies in restorative dentistry are focused on satisfying dentists' and patients' expectations. Teeth with severe mal-alignment, extensive restorations, considerable para-functional habits and severe discolorations should not be treated with veneers.<sup>5</sup>

Clinicians varietv have a of alternatives and can choose from a variety of esthetic restorative materials, including composite resins and ceramics. Resin composite has been the preferred material for conservative and cosmetic procedures for a long time as not require complicated equipment and provide a relatively inexpensive treatment. Composite resin

veneers are considered as an ideal option because of less invasive and more conservative treatment procedures which undertaken to mask discolored teeth, restore fractured teeth, and improve mal aligned teeth form.<sup>6</sup>

Direct laminate veneers involve the artistic application of resin composite material to the tooth surfaces to treat the aesthetic defects of color and shape. They are considered rivals to ceramic veneers as being a chair-side procedure, being easily repaired and have comparable abrasion rates as those of natural teeth. The ability of the clinician to restore the tooth's color, form, and contour is essential to the success of direct restorative veneers. Direct veneer restoration is a straightforward procedure when performed correctly that yields functional and aesthetic improvements in one clinical session that are instantaneous, pleasant, and long-lasting.<sup>7</sup>

However, color stability is considered as common clinical problem with direct resin composite veneers and this cause a decrease in the esthetic outcome over long time of clinical service.<sup>8</sup> Color stability is defined as the ability of any dental material to maintain its original color. A lot of clinical variables in the oral cavity, such as drinking patterns, dental hygiene practices, humidity and oral temperature changes influence color stability of laminate veneers restorations and make them more susceptible to discoloration after prolonged exposure.<sup>9</sup>

The introduction of universal composites streamlines the clinical restorative procedure and greatly simplifies clinical shade matching and significantly decreases chair-side time.<sup>10,11</sup> These composite resins represent a simplified type of consistent viscosity for which the stratification approach done.<sup>12</sup> OMNICHROMA is a novel structurally colored universal resin composite. Its broad color matching ability allows one single shade to aesthetically match all 16 of the VITA classical shades.<sup>13</sup> The potential

benefits of structural color are expected to have less color change in the shade over time as a result of decreased photochemical deterioration.<sup>14</sup>

The clinical evaluation of the success of restorative procedure mainly depends on the durability and longevity of the restorations when compared to in vitro tests. One of the most important parameters associated with durability of direct composite veneers is color stability.<sup>15</sup> The study's null hypothesis was that there was no significant clinical difference in the color stability between single and multi-shade direct composite resin veneers.

#### Materials and methods Study design

This study was performed as randomized modified split mouth clinical trial. The study was conducted in consistent with the Consolidated Standards of Reporting Trials (CONSORT).

#### **Study setting**

This study was carried out at the clinic of Department of Restorative Dentistry, Faculty of Dentistry, Tanta University.

#### Ethics approval and protocol registration

Informed consents were obtained from patients according to the guidelines on human research adopted by the Research Ethics committee, Faculty of Dentistry, Tanta University with approval number #R-05-22-This study 5. was registered at www.clinicaltrials.gov; with the identification number NCT06510400 on 18/07/2024- 'retrospectively registered'. All procedures done in this study were carried out by the Helsinki Declaration.

#### **Inclusion and exclusion criteria**

The inclusion criteria consisted of cooperative patients who exhibited good oral hygiene and had discolored vital anterior teeth due to mild intrinsic discoloration such as mild tetracycline stains, hypoplasia or fluorosis. Additionally, patients had good general health without any relevant medical disease that compromised the restorative work. Uncooperative patients, pregnant or lactating women were excluded from the study. Also, patients who demonstrated any para functional habits, extreme internal discoloration and had non vital or endodontically treated teeth were not considered eligible.

#### Sample size calculation

The power analysis and sample size was calculated using computer program G power version 3 at 0.05 significance level and 95% confidence limit with 80% power of the study. An over sizing of the study samples were made to 44 veneers for each group distributed on 20 patients to compensate the probable failure in recall visits. Sixteen patients received sixty four veneers for their upper central and lateral incisors, while four patients received twenty four veneers for their upper central and lateral incisors and canines. The upper central incisors were restored with the same kind of restorative material in order to prevent any discernible shade variations.

#### **Materials**

The materials used in this study were supra nano filled resin composite (OMNICHROMA) single shade with Palfique bond adhesive and nanohybrid composite resin (Ceram. x spectra<sup>TM</sup> ST) multi-shade with Prime&Bond adhesive material. The materials were tabulated in Table (1).

Materials	Chemical compositions	Manufactures	Website	
OMNICHROMA supra nano filled resin composite	UDMA, TEGDMA, Dibutyl hydroxyl toluene and UV absorber, Mequinol ,260 nm uniform sized supra- nano spherical silica- zirconia particles SiO2-ZrO2	Tokuyama, Tokyo, Japan	www.tokuyama -dental.com	
Palfique bond self-etch adhesive	Bis-GMA, TEGDMA,HEMA ,camphorquinone, isopropyl alcohol,purified water	Tokuyama Tokyo, Japan	www.tokuyama -dental.com	50
Ceram. X Spectra™ ST nanohybrid composite resin	PUMA, TEGDMA, methacrylic polysiloxane nano- particles. prepolymerized Sphere/TEC <sup>TM</sup> barium glass and ytterbium fluoride	Dentsply Konstanz, Germany	www.dentsplysirona.com	
Prime&Bond Universal adhesive	Bi- and acrylate, Phosphoric acid multifunctional modified acrylate resin Isopropanol, water	Dentsply 'Konstanz, Germany	www.de/ntsplysirona.com	0

 Table 1: Materials used in the study

Abbreviations: Bis-GMA: bisphenol A-glycidyl methacrylate, HEMA: 2-Hydroxyethyle Methacrylate, UDMA: urethane dimethacrylate, TEGDMA: triethylene glycol dimethacrylate, PUMA: Poly-urethane methacrylate.

#### **Patient selection**

Twenty patients of an age ranging between (18-40) had at least four discolored vital anterior teeth were selected from the clinic of Restorative Department, Faculty of Dentistry, Tanta University. The selected patients were given proper oral hygiene instructions before any restorative treatment procedure. The patients were referred to the periodontology department to receive full mouth scaling and polishing for their teeth.

#### **Clinical procedures**

The use of the collected data of shade determination from the inspected teeth before preparation was done. Window preparations for veneers were prepared on the labial surface of vital anterior teeth to depth of 0.3– 0.5 mm. Diamond depth cut wheels (Depth cutter wheels, Komet, Germany) were utilized to scribe horizontal depth cut orientation grooves on the labial surface for minimal preparations. Afterwards, a tapered diamond stone with a round end was used to remove the remaining enamel islands all the way down to the depth of the orientation grooves to uniformly reduce the labial surfaces of teeth.<sup>17,18</sup>

The prepared enamel surfaces were etched for 15 seconds with 37% phosphoric acid gel followed by water rinse and drying. A total of 88 direct composite veneers were randomly divided into two equal groups:

**Group I-** Restored with OMNICHROMA with Palfique bond adhesive which was applied for 10 seconds and cured. OMNICHROMA was applied with the U-Veneer template (Ultradent, South Jordan, United States) and cured for 20 seconds.

**Group II-** Restored with Ceram. x spectra<sup>TM</sup> ST with Prime&Bond universal adhesive. Ceram. x spectra<sup>TM</sup> ST was applied similar to group I.

After light curing of composite resin, the U-Veneer template was removed by pulling on the handle, revealing a highly polished veneer surface. Surgical scalpel blades 12 and 15 were used for finishing and removing any excess of resin composite materials beyond the proper outline of veneers form.

#### **Color stability evaluation**

Color change measurements ( $\Delta E$ ) were performed with a spectrophotometer VITA Easyshade V by two calibrated investigators who were not involved in the placement of veneer restorations at baseline, 6, 9, 12 and 18 months of recall, the device was calibrated prior to each reading. After air drying, the color changes measurements were all taken in the same ambient light circumstances. For each tooth. the active tip of the

spectrophotometer was positioned vertically at the middle third of the facial surfaces of the composite veneer restorations to standardize the exact position of the readings visually and L\*, a\*, and b\* were recorded. Where L\* represents brightness, a\* represents redness (positive direction) or greenness (negative direction), and b\* represents yellowness (positive direction) or blueness (negative direction). The  $\Delta E$  value calculated for each restoration was computed utilizing the subsequent CIELAB formula:

 $\Delta E = [(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2]^{1/2}$ Color changes ( $\Delta E$ ) values lower than 1.0 were thought to be invisible by the human eye, values between 1.0 and 3.3 were thought to be apparent to well-trained operators, but clinically acceptable, and values greater than 3.3 were considered visible to no skilled people and regarded as clinically unacceptable.

#### Statistical analysis

Data were gathered from both groups were statistically assessed using software statistical package for social sciences version 26. The Shapiro-Wilk's test was performed to check the normality of the data. Data were presented as mean and standard deviation values and were analyzed using independent t -test and one-way ANOVA, followed by multiple comparisons Tukey's post hoc test; to detect the significance between different evaluation periods.

#### Results

Descriptive statistics concerning the recorded mean  $\Delta E$  values and color coordinates (L\*, a\*, and b\*)  $\pm$  standard deviation (S.D) were used to illustrate the color stability of veneer restorations at different follow up periods in both tested groups. Numerical variables in both tested groups were expressed as mean (X<sup>-</sup>), standard deviation (SD), as presented Table (2) and

(3). Significance was inferred at p value  $\leq$  0.05.

Table 2: The mean  $\pm$  standard deviation and range values of ( $\Delta E$ ) composite veneer restorations of both tested groups at different evaluation periods

Groups	Grouj	ρI	Group II (Ceram. x		
Variables	(OMNICH	ROMA)	spectra <sup>TM</sup> ST)		
	ΔI	Ξ	ΔΕ		
	$\bar{X}$ ±S.D	Range	<i>X</i> ±S.D	Range	
Baseline	$1.62 \pm 0.63$	0.6–2.9	$1.94 \pm 0.67$	0.7-3.2	
After 6 months	1.90± 0.75	0.8–3.6	2.20±0.63	0.9–3.5	
After 9 months	2.05±0.62	0.9–3.8	2.22±0.70	1.1–3.7	
After 12 months	2.43±0.83	1.2-3.9	2.85±0.84	1.5–4.7	
After 18 months	2.79±0.88	1.4-4.5	3.15±1.10	1.7–5.4	

Table 3: Subjective data of the mean  $\pm$  standard deviation of color coordinates ( $\Delta L^*$ ,  $\Delta a^*$ , and  $\Delta b^*$ ) composite veneer restorations of both tested groups at different evaluation periods

Groups Variables	Group	I (OMNICH	ROMA)	Group II (Ceram. x spectra <sup>TM</sup> )		
V	$\Delta L^*$	∆a*	∆b*	ΔL	∆a*	∆b*
2	<i>X</i> ±S.D	<i>X</i> ±S.D	<i>X</i> ±S.D	$\bar{X}$ ±S.D	<i>X</i> ±S.D	<i>X</i> ±S.D
Baseline	1.08±0.89	0.64± 0.13	1.88± 0.92	1.32±0.56	0.81± 0.34	0.62± 0.57
After 6 months	$1.02 \pm 0.52$	0.59±0.11	0.98± 0.59	1.21±1.47	0.62± 0.42	1.83± 0.63
After 9 months	1.16±0.91	0.71±0.21	1.02±0.13	1.39±1.33	0.91±0.12	1.7±1.93
After 12 months	-1.24±1.83	$0.54{\pm}0.97$	1.18± 1.99	-1.41±2.21	0.95± 0.16	1.02±1.28
After 18 months	-1.15±2.98	1.01± 0.23	1.19± 1.01	-2.15±3.10	$-1.01 \pm 0.31$	2.31± 0.82

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Shapiro-Wilk test was performed to test distribution of color changes data. Being normally distributed, the independent t -test was performed to compare color change values between both tested groups at each follow up period. It was seen that there was no significant difference between both tested groups except at baseline and twelve months follow up period where P-value recorded (0.025) and (0.023) respectively. These finding were presented in Table (4).

Table 4: Statistical analysis of independent t-test of the mean ( $\Delta E$ ) values of composite veneer restorations of both tested groups at different evaluation periods

Groups Variables	Group I (OMNICHROMA	Group II (Ceram. x spectra <sup>TM</sup> ST	am. x Test color char ST both group	
	Composite resin)	Composite resin)	0	
	<i>X</i> ±S.D	$\bar{X}\pm$ S.D	t-test	p-value
Baseline	$1.62 \pm 0.63$	$1.94 \pm 0.67$	-2.274	0.025
After 6 months	1.90±0.75	2.20±0.63	-1.969	0.052
After 9 months	2.05±0.62	2.22±0.70	-1.233	0.221
After 12 months	2.43±0.83	2.85±0.84	-2.312	0.023
After 18 months	2.79±0.88	3.15±1.10	-1.698	0.093

One way analysis of variance was performed to compare values of color changes at different evaluation period within each group with P-value <0.05 considered significant in Table (5). One way ANOVA showed that there was highly statistical significant difference between color change values at different evaluation periods for group I (F=15.8, P-value=0.000). Also, for group II One way ANOVA revealed that there was highly statistical significant difference between color change values at different follow up periods (F=16.68, Pvalue=0.000). Whenever a statistically significant difference was recorded, Tukey's test was performed to make pair-wise comparison to detect the significance as seen in. This led to fetch out which follow up periods were responsible for statistical significant difference observed. Multiple comparisons Tukey's test revealed that for there was a statistically highly group I, significant difference (P-value =  $0.000^{**}$ ) between the results of baseline versus both 12 & 18 months follow up periods. Also, a statistically highly significant difference (Pvalue =  $0.000^{**}$ ) between the results of 6 months versus both 12 & 18 months evaluation periods and between the results of 9 months versus 18 months evaluation periods. On the other hand, the difference was

not significant between the results of baseline versus both 6 and 9 months follow up periods (P-value = 0.407 and 0.069) respectively, or between 6 months versus 9 months evaluation periods (P-value = 0.904). Once more no significant difference was seen between 9 months versus 12 months (P-value = 0.138), or between 12 months versus 18 months follow up periods (P-value = 0.175).

For group II, Tukey's test revealed there was a statistically significant difference between the results of baseline versus 12& 18 months evaluation periods (P-value = 0.000\*\*) and between 6 months versus 12&18 months (P-value =  $0.0030^{**}$  and 0.000\*\*) respectively and between 9 months versus 12&18 months follow up periods (Pvalue =  $0.0040^{**}$  and  $0.000^{**}$ ) respectively (Table 5). While the difference was not significant between the results of baseline versus 6 and 9 months (P-value = 0.584 and 0. 491) respectively, (table 6) or between 6 months versus 9 months evaluation periods (P-value = 1.000). Also, no significant difference between 12 months versus 18 months follow up periods (P-value = 0.395).

Table 5: One way	ANOVA	test	comparing	the
mean ( $\Delta E$ ) values of	composit	e ven	eer restorat	ions
of each tested group	at differe	nt eva	aluation per	iods

)	Mean Color Change Values							
	Groups	Baseline	6 Months	9 Months	12Months	18Months	ANO	VA Test
		Mean ± S.D	F	p-value				
0	Group I	1.62± 0.63	1.90± 0.75	2.05±0.62	2.43±0.83	2.79±0.88	15.8	0.000**
	Group II	1.94± 0.67	2.20±0.63	2.22±0.70	2.85±0.84	3.15±1.10	16.68	0.000**

Table	6:	Multiple	comparisons	Tukey's	test for
group	I ((	OMNICH	ROMA) and g	roup II (O	Ceram. x
spectra	атм	ST) at dif	fferent evaluat	tion perio	ds

1	,		
Multiple comparison Tukey's		P-value (group	P-value (group
		I)	II)
test for gro	oup I and		
ĨI	•		
24 hours	6 <sup>th</sup>	0.407	0.584
	month		
	9 <sup>th</sup>	0.069	0.491
	month		
	12 <sup>th</sup>	0.000	0.000
	month		
	18 <sup>th</sup>	0.000	0.000
	month		
6 <sup>th</sup>	9 <sup>th</sup>	0.904	1.000
month	month		
	12 <sup>th</sup>	0.013	0.003
	month		100
	18 <sup>th</sup>	0.000	0.000
	month		1.
9 <sup>th</sup>	12 <sup>th</sup>	0.138	0.004
month	month		
	18 <sup>th</sup>	0.000	0.000
	month		
12 <sup>th</sup>	18 <sup>th</sup>	0.175	0.395
month	month	1	
	Mult comparison test for gro II 24 hours 6 <sup>th</sup> month 9 <sup>th</sup> month	Multiple comparison Tukey's test for group I and II24 hours $6^{th}$ month24 hours $6^{th}$ month12 <sup>th</sup> month $12^{th}$ month18 <sup>th</sup> month $12^{th}$ month6 <sup>th</sup> $9^{th}$ month18 <sup>th</sup> month $12^{th}$ month9 <sup>th</sup> $12^{th}$ month18 <sup>th</sup> month $12^{th}$ month9 <sup>th</sup> $12^{th}$ month9 <sup>th</sup> $12^{th}$ month9 <sup>th</sup> $12^{th}$ month12 <sup>th</sup> month $18^{th}$ month	$\begin{tabular}{ c c c c } \hline Multiple & P-value (group \\ comparison Tukey's test for group I and II & I) & I) & I) & I & I & I & I & I &$

#### Discussion

Recently, there was a continuous evolution in esthetic restorative dentistry that contributed to a significant improvement of resin composites, adhesive bonding systems and clinical restorative protocols.<sup>19</sup> The use of direct composite veneers could be one of the most viable treatment options to restore the aesthetic of discolored teeth particularly since indirect restorative techniques require more removal of healthy teeth structure and more expensive, because of laboratory procedures included. As a matter of fact, direct composite veneers seem to be the first preferred choice to improve the patient's smile with a minimal invasive manner.<sup>20</sup>

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Ceram.X Spectra<sup>™</sup> ST was employed in the present study as its sophisticated blending capability; only five universal CLOUD shades (A1, A2, A3, A3.5 and A4) are required to match the entire VITA® spectrum of 16 shades which simplify the shade matching procedure. The shade of Spectra ST composite restorations is influenced by the color of the surrounding tooth structure as SphereTEC® fillers have been formulated to balance opacity, translucency, light absorption and scattering.<sup>21</sup>

Also, OMNICHROMA was chosen as its broad color matching ability eliminates the need for a shade assessment procedure as it was the first composite resin-based material that could match any tooth with any shade due to its smart chromatic technology as it has the capability to capture the structural color of the surrounding teeth that is controlled by the size of its supra-nano spherical filler particles.<sup>22</sup>

As of right now, window preparation is utilized as a very conservative, minimally invasive veneer preparation technique that only needs a 0.3–0.5 mm depth of enamel reduction in the teeth. It was reported that window preparation design retains more tooth structure as it does not include reduction of the incisal edge and has reduced probability of marginal discrepancy along the margins of veneer restorations than other preparation types.<sup>23</sup>

In the current study, the U-Veneer kit was used to more rapidly and efficiently create veneers that replicated the precise anatomic natural contours of teeth while maintaining predicted form and symmetry. Additionally, these templates provide a highly polished glossy surface, enhancing the strength of the resin composite and eliminating the need for polishing techniques because they eliminate the formation of an oxygen inhibition layer during the curing process which has a significant effect in the physic mechanical properties of composite resin.<sup>24</sup> During composite light-curing, the contact of oxygen produces a surface layer of uncured resin as the oxygen inhibits the polymerization reaction, resulting in the formation of a polymer chain more prone to staining and color changes. The use of U-Veneer prevents this layer from being formed as reported by Dindar MB and Atay MT.<sup>25</sup>

Regarding the color stability of veneer restorations, which is an important esthetic

Clinical Evaluation of Color Stability of Direct Composite Resin Veneers in Vital Anterior Teeth | Mohammed Abd El Ghany Mohammed et al. MARCH2025. issue for veneer restorations.<sup>26</sup> In the present study, the recorded mean color change values ( $\Delta E$ ) of all veneer restorations for both tested groups are above the perceptibility threshold of ( $\Delta E < 1$ ) and within the acceptability threshold ( $\Delta E < 3.3$ ) without any clinically significance differences. Two principal thresholds were used to assess the color differences: perceptibility threshold (PT) and acceptability threshold (AT).<sup>27</sup>

For a veneer restoration to be successful, the color stability of aesthetic dental restorative materials must be acceptable. It has been demonstrated that dental spectrophotometers offer the best overall accuracy and precision for measuring the color changes. The total color difference ( $\Delta E$ ) in the present study was monitored for acceptability and perceptibility threshold and measured using a spectrophotometer (VITA Easyshade **®** V) as recommended in literature.<sup>28,29</sup>

In the present study, after the 12 and 18 month follow-up periods, the mean ( $\Delta L^*$ ) parameter of both composite veneer materials was negative, indicating that all veneers' lightness slightly decreased and turned darker by time. This is consistent with findings from earlier in-vitro studies regarding the color stability of composite veneers, which also revealed a decrease in the L\*. This is due to the fact that resin composite may be more prone to degradation as a result of the presence of unreacted carbon double bonds, which vary in frequency depending on the degree of conversion. This can also affect the composite's opacity by changing the refractive index through a scattering pattern.<sup>30</sup>

During all evaluation periods, the mean  $\Delta a^*$  for OMNICHROMA and Ceram x spectra<sup>TM</sup> ST were shifted towards the red, with the exception of Ceram x spectra<sup>TM</sup> ST which only shifted toward the green at the 18-month. The increasing redness indicates the impact of amine-based accelerators in the

resin composites. This is because, when exposed to light or heat, all amines create byproducts during photoreaction that often result in yellow to red-brown discolorations.<sup>31</sup>

While, mean  $\Delta b^*$  values of both veneer materials exhibited positive mean and shifted to yellow thought the study period. This because of the could be kind of photoinitiators that were employed in their formulation; camphorquinone along with electron donor tertiary amine DMAEMA and EDMAB as co initiator in the composite resin result in an undesirably yellowish effect in the composite veneers after curing. Furthermore, the ratio of camphorquinone/amine influences the composite resin's color shift, as a greater amine rate is expected to generate a more noticeable yellowish impact because an excess of amine has a great potential to cause darkness due to oxidative processes.<sup>32</sup>

The perceptible value for  $\Delta E$  in a 50%:50% threshold was established to be 1 ( $\Delta E < 1$ ), while the acceptance value for the color difference was estimated to be 3.3 ( $\Delta E < 3.3$ ). Others reported that  $\Delta E$  values in the range of 1.0 to 3.7 are noticeable to the human eye; they fall within the clinically acceptable range of 2.72 to 6.8, which is contingent upon the degree of translucency and polychromacity of the teeth adjacent to the veneer restoration.<sup>33</sup> All veneers of present study showed accepted clinical performance regarding color stability.

Composite resin discoloration is multifactorial, including factors such as intrinsic and extrinsic. Intrinsic discoloration has been related to the chemical composition of the resin matrix, oxidation of unreacted carbon double bonds, degeneration of the bond between the matrix and the filler, filler and monomer types and the degree of conversion. On the other hand, extrinsic factors are related to adsorption or absorption of extrinsic stains from colored food or drinks.<sup>34</sup>

The volume and size of fillers have an effect on composite staining susceptibility and color stability. When the filler size and quantity were increased, the organic matrix was reduced. The degree of color change will be reduced as a result. In the present study, both OMNICHROMA and Ceram x contains nano-fillers with high filler loading (79 % by weight, 68 % by volume) for OMNICHROMA and (78-80 % by weight, 60-62% by volume) for Ceram x spectra. These current findings could be attributed to selected individuals with an inclusion criteria having good oral hygiene and restricted to follow the post-operative instructions such as keep proper dental hygiene, no smoking, decrease up take of coffee and tea and proper brushing techniques which play an important role in the clinical changes of color stability of veneers.35

Al-Saudi K et al., agreed with the current results and evaluated the color and gloss stability of various contemporary universal composites. The findings revealed that nanofilled Omnichroma and nanohybrid Filtek universal demonstrated superior performance in color and gloss stability compared to nanohybrid Spectra ST and nanofilled Filtek Z350 XT after subjected to varying periods of artificially accelerated aging as  $\Delta E^*$  remained < 3.3. They concluded that the filler amount, particle size and type are the main influencing factors that determine the final characteristics of the composite resin, and this has a direct effect on the color stability and restoration's longevity.<sup>36</sup>

Additionally, the majority of the change in color is caused by the fillers detaching from the resin due to hydrolysis at the resinfiller interface caused by the resin's absorption of fluid. Type of the resin could have an impact on the color change, as some resin monomers can be classified as stain resistant and others as non-stain resistant.<sup>37</sup> UDMA is a hydrophobic monomer rendering it more stain resistant whereas TGDMA exhibits a degree of water absorption thus enables to seep the hydrophilic colorant into the resin matrix. The least stain-resistant monomer is BIS-GMA because it is hydrophilic and has a high water sorption potency.<sup>38</sup>

Also, Abo-Eldahab G and Kamel M reported that Omnichroma supra-nano-filled obtained less color change over time than the nanofilled resin composite due to presence of UDMA based matrix of Omnichroma which worked in favor of a more stain resistant surface than the Bis-GMA based matrix of Filtek Z 350xt, however both have a clinically acceptable values  $\Delta E^*$  (2.36±0.22 in Filtek and 2.11±0.33 in Omnichroma). They explained that UDMA has low viscosity and subsequently more flexible than Bis-GMA, which increase its degree of conversion and form denser polymer network. Moreover, its higher filler content of Omnichroma (68% by volume) than that of the Filtek Z 350xt (63.3% by volume).<sup>39</sup>

The current results are consistent with the findings of previous studies done by FAZLIOGLU L et al., who assessed the color changes of nano-hybrid composite Ceram X SphereTEC and single shade supra-nano filled composite Omnichroma after immersion in different beverages: tea, coffee, cola and distilled water. Color change ( $\Delta E$ ) before and after immersion in beverages were calculated using Vita easv shade spectrophotometer device and revealed that no significant differences in terms of color change were observed.<sup>40</sup>

In contrast to our present results, El-Rashidy AA et al., evaluated the color stability of single-shade versus multi-shade resin composites. They concluded that both resin-composites; the single-shade (Omnichroma) and multi-shade (Filtek Z350-XT) displayed unacceptable discoloration and gloss reduction after artificial-aging in tea and red-wine by immersion or thermocycling simulating one-year clinicalservice.<sup>41</sup> Also, Abdelhamed B et al., investigated the color durability of supra nano filled Omnichroma and nano-hybrid Essentia composite and reported that Omnichroma had highest significant color changes than Essentia. This might be attributed to the chemical composition of to Essentia matrix which is based on BISEMA which is more hydrophobic in nature and less water sorption compared to UDMA of Omnichroma matrix.<sup>42</sup>

#### Conclusion

Within the limitation of the present study, it was concluded that the single and multishade resin composite veneers have comparable acceptable clinical performance regarding the color stability after 18 months follow up period; also color stability parameter is significantly impacted by time factor during the study.

#### **Declarations**

#### Ethics approval and consent to participate

The study was approved by the Research Ethics Committee Faculty of Dentistry, Tanta University. The approval number RD-5-22-5. Informed consents were obtained from all patients included in the study.

# Competing interests Ain Shams Dent

The authors declare no potential conflicts of interest.

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#### **Data Availability**

The data are not publicly available due to patients' privacy but are available from the corresponding author upon appropriate request.

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