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EFFECT OF HEATED COMPOSITE CEMENT AND WEAR WITH DIFFERENT OPPOSING SURFACES ON COLOR OF CAD/CAM CERAMIC OCCLUSAL VENEERS

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ABSTRACT

Statement of problem: improvement and maintain color stability of ceramic restorations is necessary factor for long success of esthetic fixed Prosthodontic restorations. Posterior occlusal ceramic and hybrid ceramic veneers are widely used as a clinical restorative treatment to improve appearance and restore the lost enamel. The abrasiveness limitation of different ceramics materials and its effect on color stability of both enamel and different opposing occlusal restorative materials are very important when selecting as an esthetic restorative material. In addition, recently, composite resin has been used as luting cement for indirect aesthetic restorations. The flow of the pre-heating composite as luting agent improves the adaptation and facilitate the placement of the restoration. Therefore, the effect of heat on color stability of composite as luting agent and its reflection on the color of occlusal ceramic veneers restorations are needed

Objectives: this study was to investigate the effect of heating of flowable composite as luting agent and the wear of occlusal veneer ceramic restoration with different opposing(enamel, e. max and v. enamic) on the color of e. max and vita enamic CAD/CAM posterior occlusal veneers ceramic restorations.

Materials and Methods: 20 extracted human upper premolars were prepared for occlusal veneers were scanned and CAD-CAM restorations were milled using e max and vita enamic CAD/CAM blocks with the same milling parameters. CAD/CAM posterior ceramic occlusal veneers restorations were cemented using flowable composite material before and after heating. Wear of occlusal veneers using chewing simulator (ROBOTA) with different opposing: human enamel, e. max and v. enamic CAD/CAM discs was used. The effect of wear and flowable composite heating on color stability were measured and the data were tabulated and analyzed statistically.

Results: Total effect of heating of composite cement; regardless to occlusal veneers restorations material groups or mechanical wear, it was found that composite resin cement heating affected color stability significantly (p=0.05 > 0.00095) as indicated three way ANOVA test where

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(non-heated composite cement (ΔE) mean value = 5.94 > heated composite cement (ΔE) mean value = 4.53). Total effect of mechanical wear; irrespective of occlusal veneer material groups or composite resin cement heating, it was found that mechanical wear affected color stability non-significantly ($p=0.05 <0.5776$) as indicated three way ANOVA test where (After aging (ΔE) mean value = 5.38 ≥ before aging (ΔE) mean value = 5.09)

Conclusions: selection of the occlusal veneers materials should consider wear properties because the occlusal wear rate varies according to the materials of the occlusal veneers restoration and opposing surfaces as well as the applied load. Moreover, for best aesthetic results, clinicians must be taken in considerations the color, translucency of ceramics and the effects of the luting agent on optical properties.

KEY WORDS: Occlusal veneers, preheated flowable composite, e. max ceramic, vita enamic ceramic, color stability, wear, CAD/CAM ceramic.

INTRODUCTION

Loss of tooth structure due to abrasion or erosion has been accompanying with many effective changes as in stability of occlusion, tooth sensitivity, skeletomuscular harmony, jaw relationships, and finally in esthetics. To restore such pathologic tooth, various modifications of preparation design, an endodontic treatment and/or periodontal surgical interference are required. [1].

Loss of the tooth anatomic form caused by wear can alter the functions of the masticatory apparatus. Restoration of occlusal surface with full-coverage crowns requires considerable amount of sound tooth structure removal. Gold alloys are considered the most similar to enamel in function and wear characteristics. However, due to their esthetic cause them to be unaccepted. Therefore, the Patients who need a slight increase in occlusal height, Posterior ceramic onlays and occlusal veneers are used to stabilize the occlusal plane. In these cases, the enamel surface was prepared to receive the adhesively bonded occlusal onlay. Recently CAD/CAM ceramic occlusal veneers with conservative tooth preparation has also been used as an effective treatment for rehabilitation of severe dental erosion [2-5].

In some studies, all-ceramic restorations were avoided, with increased chewing forces due to bruxism or parafunctions in rehabilitated patients, due to the risk of ceramic fracture. Metal occlusal surfaces restorations were the preferred restoration for these patients; however, these types of restorations did not achieve the esthetic demands of patients [2, 6-7].

According to Seghi et al. (1991) [8], The restorative material that replaces the lost enamel should have wear rate as enamel wear rate and should not cause more wear of the enamel it opposes than enamel itself. The proper selection of restorative materials is important to preserve function, esthetics and occlusal harmony. [9]

A rough surface restoration will cause plaque accumulation, abrasion to opposing teeth, and esthetic and biomechanical failure of restoration. The highly surface polished of e-max ceramics restorstion are more stable and are more resist degradation in the oral environment. [10-12]

Vita enamic is a nano-hybrid ceramic, combining both strength and color stability of ceramic and the resilience of resin. Therefore wear and forces transmitted to underlying structures are decreased . However surface degradation and roughening of the resin matrix, may be occur due to the oral environment or aging and affect the color stability and long-term esthetic success of the restoration.[10,13]

The success and the longevity of the restoration depends on the colors stability of the restoration , in addition to the color of the supporting tooth substructure, thickness, shade and type of ceramic and resin cement, and the restorative material's translucency. The activation system of resin cements may have an influence on the color stability of thin restorations. The Camphroquene initiator that is used with light-cured cements is more color stable than the benzoyl peroxide used with chemical or dual cured cements, the light-cured cements, is preferred due to longer clinical working time. Self-adhesive cements appeared with the proposal of simplifying the adhesive bonding technique, with application of cement in a single step, eliminating the prior treatment of dental substrate and diminishing the technique sensitivity. [14-20].

Some authors demonstrated that preheated composite resin restorations for ten minutes (54°C and 68°C) did not impair the properties of the polymerized material. Preheating highly filled resin composites resulted in easier handling; improve the adaptation of the composite; decrease the trapped air and voids at the margins or the bulk of the restoration; improve the physical and mechanical properties of the final restoration due to increase the monomer conversion, increase the bond strength and decrease the marginal gap. Therefore, it is recommended by some researchers to use preheated restorative hybrid composite resin as a luting for porcelain laminate veneers. [21-27].

However, the available data about the effect of pre heated composite material as luting agent on color stability of CAD/CAM posterior ceramic and hybird occlusal veneers restorations are few. In addition, the effects of wear on the color stability of ceramic restoration are few, particularly the effect on thin occlusal veneers restorations.

Therefore, the aim of this study was to investigate the effect of wear of ceramic and hybrid ceramic posterior occlusal veneers when opposed with different surfaces, on color stability of the vita ceramic and e-max CAD/CAM posterior ceramic occlusal veneer restorations, with and without preheating the flowable composite luting agent.

MATERIALS AND METHOD

Preparation of occlusal surface of teeth for occlusal veneers

Twenty natural non-carious maxillary first premolar teeth, were selected for this study. All the teeth were scaled, cleaned with a rubber cup and fine pumice-water slurry then were stored in artificial saliva solution at room temperature. (Prepared in Lab. of faculty of Pharmacy, Misr University for science and technology) according to Fusayama [28, 29].

Nearly flat occlusal surface represent a clinical teeth wear were prepared, using a high speed diamond tapered deep purple dental stone (Komet USA). mounted to a milling machine (**NOUVAG** AF30 milling machine, Swizerland) perpendicular to the long axis of the teeth then the preparations were finished with the identically shaped finisher stone. This allow construction of occlusal veneer with proper contour and standardize occlusal cusp morphology. All line and point angles were rounded.

Prepared teeth were divided into two groups 10 of each according to the type of occlusal veneer materials :(gr1) IPS e. max CAD/CAM ceramic restorative material and (gr2) Vita enamic CAD/CAM ceramic restorative material. Each group was further divided into two sub-groups, of 5 teeth each according to the heating of the composite resin cement materials: Sub-group (a): non heated composite resin and Sub-group (b): heated composite resin.

Construction of occlusal veneers:

- (gr1) the occlusal veneers were constructed from IPS e. max CAD, (Ivoclar, Liechtenstein) All IPS e. max CAD blocks (C14) was selected with shade A2 HT.
- (gr2) the occlusal veneers were constructed from Vita enamic CAD blocks (Vita Zahnfabrik, Bad Säckingen, Germany). CAD Vita enamic blocks (C14) were selected with shade 2n2 HT.

The prepared occlusal surfaces of all premolars were scanned using 3D optical scanner Identica blue (Medit, Korea), occlusal veneers of the corresponding tooth sample was designed using Exo CAD software, (Germany). Then all occlusal ceramic veneers designs were imported to the milling machine and CAD/CAM ceramic blocks was prepared using USF \ CAM 5 S milling machine (Germany). Then ceramic block was milled with cusp height 1.5mm and central fossa 1 mm. (Fig 1)

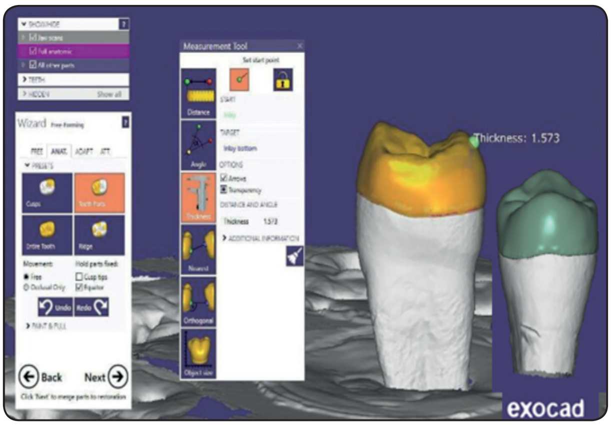

Fig. (1): Occlusal veneers preparation

Bonding procedures of ceramic occlusal veneers restorations:

The internal surfaces of occlusal veneers vita enamic CAD restorations and occlusal veneers IPS e. max CAD restorations were etched using hydrofluoric etchant (5g tube weight)(9.5%HF) buffered hydrofluoric acid gel (Bisco, Inc 1100W. Irving park Rd. Schaumburg, IL 60193 847-534-6000 USA) for 90 sec., was rinsed with a copious amount of water, and then was air dried. The etched surface appeared dull and frosty. One to two layer of silane (Pentron clinical, Technologies, LLC, and 68 N. Plains Industrial Rd. Wallingford, CT USA 06492.203-265-7397) was applied to the internal etched surface of the occlusal veneers according to the manufacturer instructions, and was dried with air syringe. Then, the primer adhesive c &b 6ml\6gm (Pentron clinical, Technologies, LLC, and 68 N. Plains Industrial Rd. Wallingford, CT USA patent No. 203-265-7397) were applied. Finally, according to the manufacturer's instructions the internal surfaces of the occlusal veneers was cemented with light - polymerizing flow composite 4 x 1.2gm syringe w/ tips (MASTER-DENT LC , Dentonics INC, USA 8382 REF: 19-414-A1) according to the classification of the group. Sub-group (a) was cemented with non-heated light cure composite resin (1a and 2a), and Sub-group (b) was immediately cemented with heated composite resin (1b and 2b) where resin composite heated externally using incubator unit (LabTech LDO-080N Korea) to a temperature of 54oc for 5min. then the composite was placed as quickly as possible[30].

The prepared tooth surface was etched with 37% phosphoric acid Etchant gel(Charm Etch, 37(LV) DENTKIST, Inc, 1412004 Korea). The gel was applied to the prepared enamel for 30 seconds and on the dentin for 15 seconds. Then, the etchant gel was removed with water spray and air dried. A bonding agent (primer adhesive c&b 6ml\6gm (Pentron clinical, Technologies, LLC, and 68 N. Plains Industrial Rd. Wallingford, CT USA patent No. 203-265-7397). was applied to the prepared tooth surfaces.

All prepared occlusal veneer restorations were cemented using finger pressure and excess cement was removed. Then light curing unit (Ledition Germany) was used for 20s for all directions. The Cement margin was finished using flexible polishing discs (Sof- Lex XT Pop-On, 3M ESPE). All specimens was stored in artificial saliva solution.

Chewing simulator for wear of occlusal veneers

The chewing simulator (ROBOTA) (Model ACH-09075DC-T, AD-TECH TECHNOLOGY CO., LTD.GERMANY) has four chambers able to simulate the vertical and horizontal movements simultaneously in the thermodynamic condition.

Each of the chambers consists of an upper sample holder that can be tightened with a screw for use as antagonistic materials (human enamel teeth, e max disc and vita enamic discs) and a lower plastic antagonist holder housing (e max and vita enamic occlusal veneers restorations). A weight of 5 kg, which is comparable to 49 N of chewing force, was exerted. The test was repeated 37500 times to clinically simulate the 3 months chewing condition, accompanying thermocycling according to previous studies. Thermo-mechanical aging test was conducted using the newly developed four stations multi-modal ROBOTA chewing simulator* integrated with thermocyclic protocol operated on servomotor. The following Test parameters were used: Cold/hot bath temperature: 5°C/55°C, Vertical movement: 2 mm, Rising speed: 90 mm/s, Descending speed: 40 mm/s, Cycle frequency 1.6 Hz, Torque; 2.4 N.m, Dwell time: 60 s, Horizontal movement: 3 mm, Forward speed: 90 mm/s, Backward speed: 40 mm/s, Weight per sample: 5 kg. [31]

Color measurement of occlusal veneers

The colors of the occlusal veneers restorations was measured before cementation, after cementation, using heated and non-heated flowable composite resin cement and After wear simulator, using a Reflective spectrophotometer (Model RM200QC, X-Rite, Neu-Isenburg, Germany). The aperture size was set to 4 mm and the specimens was exactly aligned with the device. A white background was selected and measurements were made according to the CIE L*a*b* color space relative to the CIE standard illuminant D65. The color changes (ΔE) of the specimens was evaluated using the following formula: [32]

$$\Delta E_{CIELAB} = (\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2})\ ½$$

Where: L* = lightness (0-100), a* = (change the color of the axis red/green) and b* = (color variation axis yellow/blue)

Wear measurement of occlusal veneers and opposing surfaces by weight loss:

The substance loss of the tested samples after wear simulation was measured by weighting in the electronic analytical balance (Sartorius, Biopharmaceutical and Laboratories, Germany) with an accuracy of 0.0001 gr. to calculate the difference in weight before and after each simulated wear process. As this electronic balance had a fully automated calibration technology and a micro weighting scale, values of all the samples (e max and vita enamic occlusal veneers restorations) and antagonist discs (human enamel teeth , e. max disc and vita enamic discs) were accurately measured. Each sample was cleaned and dried with tissue paper before weighting. To ensure accuracy, the balance was kept on a free standing table at all times - away from vibrations - and weighted the samples with the glass doors of the balance closed to avoid the effect of air drafts

Surface topography characterizations

Quantitative analysis of two-body wear for e. max and vita enamic occlusal veneers restorations and their antagonists (enamel, e max and vita enamic discs) was carried out before and after loading in a 3D-surface analyzer system optically. The optical methods tend to fulfill the need for quantitative characterization of surface topography without contact [33]. Both occlusal veneers restoration materials and antagonistic discs were photographed using USB Digital microscope with a built-in camera (Scope Capture Digital Microscope, Guangdong, China) connected with an IBM compatible personal computer using a fixed magnification of 120X.The images was recorded with a resolution of 1280 × 1024 pixels per image. Digital microscope images was cropped to 350 x 400 pixels using Microsoft office picture manager to specify/standardize area of roughness measurement. The cropped images was analyzed using WSxM software (Ver 5 develop 4.1, Nanotec, Electronica, SL) [34] Within the WSxM software, all limits, sizes, frames and measured parameters are expressed in pixels. Therefore, system calibration was done to convert the pixels into absolute real world units. Calibration was made by comparing an object of known size (a ruler in this study) with a scale generated by the software. WSxM software was used to calculate average of heights (Ra) expressed in µm, which can be assumed as a reliable indices of surface roughness [35]

Subsequently, a 3D image of the surface profile of the specimens was created using a digital image analysis system (Image J 1.43U, National Institute of Health, USA). The unworn surface served as a reference. With this method, a 3-dimensional geometry of the worn surface was generated.

RESULTS

Results of color

Data analysis was performed in several steps. Initially, descriptive statistics for each group results. Multi-factorial analysis of variance ANOVA was done to detect the effect of each variable (before cementation, after cementation, heated and non-heated composite and effect of aging with different opposing surfaces (human enamel, e. max and vita enamic discs). Student t-test was performed to detect significance between two groups. Statistical analysis was performed using Aasistat 7.6 statistics software for Windows (Campina Grande, Paraiba state, Brazil). P values ≤0.05 are considered to be statistically significant in all tests.

Color change (ΔE) results (Mean ±SD) for all groups as function of resin heating and mechanical aging for both materials are summarized in table (1) and graphically drawn in (fig 2).

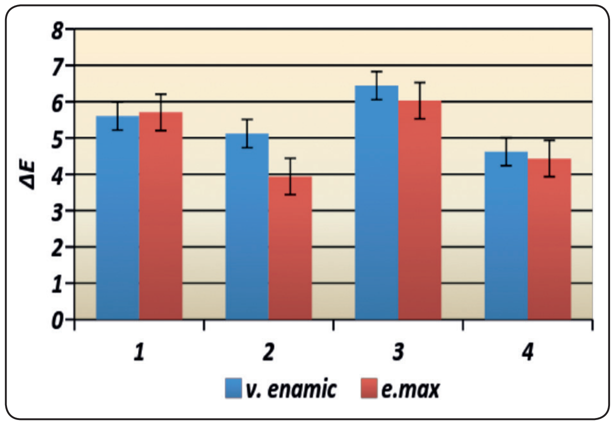

Fig (2) Histogram of colour change means values for both groups as function of resin heating and mechanical wear

Effect of heating of composite cement

e. max group after cementation It was found that composite resin cement heating affected color stability non-significantly (p=0.6801> 0.05) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 5.6 < heated composite cement (ΔE) mean value = 5.12)

v. enamic group after cementation It was found that composite resin cement heating affected color stability significantly (p=0.003< 0.05) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 5.7 > heated composite cement (ΔE) mean value = 3.9)

TABLE (1) Color change results (Mean values± SDs) for both groups as function of composite heating and mechanical aging

Variables		After cementation		After mechanical wear		ANOVA
		Non-Heated	Heated	Non-Heated	Heated	P value
Occlusal veneers restoration	e.max	5.60 ±1.17	5.12±1.09	6.44±0.85	4.62±0.52	0.2499Ns
	v.enamic	5.71±1.18	3.94±1.05	6.03±1.18	4.43±0.75	0.1463Ns
t-test	PValue	0.9287Ns	0.2491Ns	0.7019Ns	0.7409ns	

Effect of mechanical wear

e. max group It was found that composite resin cement heating affected color stability significantly (p=0.045< 0.05) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 6.4 > heated composite cement (ΔE) mean value = 4.6)

v. enamic group It was found that composite resin cement heating affected color stability significantly (p=0.047< 0.05) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 6.03 > heated composite cement (ΔE) mean value = 4.4)

Total effect of occlusal veneer restoration materials; regardless to mechanical wearing or composite heating, it was found that material groups affected color stability non-significantly (p=0.4483 > 0.05) as indicated three way ANOVA test where (e. max (ΔE) mean value = 5.45 >V. enamic (ΔE) mean value = 5.03)

Total effect of heating of composite cement; regardless to occlusal veneers restorations material groups or mechanical wear, it was found that composite resin cement heating affected color stability significantly (p=0.00095 < 0.05) as indicated three way ANOVA test where (non-heated composite cement (ΔE) mean value = 5.94 > heated composite cement (ΔE) mean value = 4.53)

Total effect of mechanical wear; irrespective of occlusal veneer material groups or composite resin cement heating, it was found that mechanical wear affected color stability non-significantly (p=0.5776> 0.05) as indicated three way ANOVA test where (After mechanical wear (ΔE) mean value = 5.38 ≥ before mechanical wear (ΔE) mean value = 5.09)

Interaction between variables

e. max vs. v. enamic after cementation

Non-heated flowable composite resin; it was found that v. enamic group recorded statistically non-significant (p=0.9287 > 0.05) higher color change mean value (5.71±1.18ΔE) than e. max group (5.60±1.17ΔE) as indicated by un-paired t-test

Heated flowable composite resin; it was found that e. max group recorded statistically non-significant (p=0.2491> 0.05) higher color change mean value (5.12±1.09ΔE) than v. enamic group (3.94±1.05ΔE) as indicated by un-paired t-test

e.max vs. v. enamic after mechanical wear

Non-heated flowable composite resin; it was found that e. max group recorded statistically non-significant (p=0.7019> 0.05) higher color change mean value (6.44±0.85ΔE) than v. enamic group (6.03±1.18ΔE) as indicated by un-paired t-test

Heated flowable composite resin; it was found that e. max group recorded statistically non-significant (p=0.7409> 0.05) higher color change mean value (4.62±0.52ΔE) than v. enamic group (4.43±0.75ΔE) as indicated by un-paired t-test

Color change (ΔE) results (Mean ± SD) for composite group as function of heating are summarized in table (2) and figure (3).

TABLE (2) Color change results (Mean values± SDs) for composite resin cement before and after heating

Sample	**Before**			**After**			Color change			
	L	A	b	L	a	b	ΔL	Δa	Δb	ΔE
1	78.9	-0.5	7.2	82	-2.4	10.1	3.1	-1.9	2.9	4.650806
2	81	-2.6	8	81.2	-2.1	9.2	0.2	0.5	1.2	1.315295
3	79.9	0.4	2.7	83.9	2	-0.7	4	1.6	-3.4	5.488169
Mean±SD							2.433333± 1.488889	0.066667± 1.311111	0.233333± 2.422222	3.81809± 1.66853

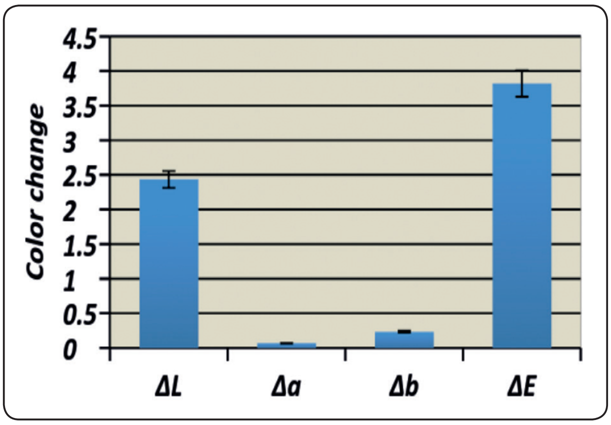

Fig. (3) a column chart showing color change mean values of composite as function of heating

Effect on (ΔL) Translucency change from baseline After heating

It was found that composite recorded statistically non-significant ($p > 0.05$) lower translucency before heating (79.93±4.5L) than after (82.37±1.02L) with translucency change mean value (2.4 ΔL) as shown in tables (2) and figure (3)

N.B. - Negative sign means become darker

- Positive sign means become lighter

Effect on (Δa) change from baseline After heating

It was found that composite recorded statistically non-significant ($p > 0.05$) lower chroma before heating (-0.9±1.1a) than after (-0.8±1.8 a) with change mean value (0.067 Δa) as shown in tables (2) and figure (3)

N.B. - Positive sign means become reddish

- Negative sign means become greenish

Effect on (Δb) change from baseline After heating

It was found that composite recorded statistically non-significant ($p > 0.05$) lower chroma before heating (5.967±2.18b) than after (6.2±4.6 b) with change mean value (0.23 Δb) as shown in tables (2) and figure (3)

N.B. - Positive sign means become yellowish

- Negative sign means become bluish

Effect on (ΔE) change from baseline after heating

It was found that **composite** recorded total color change mean value (3.8± 1.6ΔE)

Results of surface topography characterizations

Topography of surfaces after chewing simulator is extremely important as it directly affects surface roughness and eventually, the color changing of the esthetic restoration surface.

3D IPM topographies:

The constructed 3D IPM topographies of the external surfaces of the different ceramic occlusal veneers groups was shown .the length and the width of the scanning areas was presented in the x and y axes respectively in µm while the amplitude of surface characteristics was presented in the z-axis in µm. The relative height of surface characteristics was color-coded and was ranged from red for the highest areas to orange for deepest area. All the different groups was characterized by rough surface that observed all over the surfaces as an area of elevations and depressions with different dimension scales. Fig (4)

- **Quantitative analysis of Surface roughness (Ra):** as shown in tables (3,4) and figure (5)
- **Occlusal veneers ceramics restoration vs. Ceramic disc antagonist**

Ra changes in occlusal veneers ceramics restoration groups

For **v. enamic occlusal veneers restoration;** it was found that the roughness mean value before wear was (0.2599±0.0012Ra) while after wear simulation the roughness mean value was (0.255367±0.004Ra) with roughness change mean value (-0.00453±0.00039 Ra)

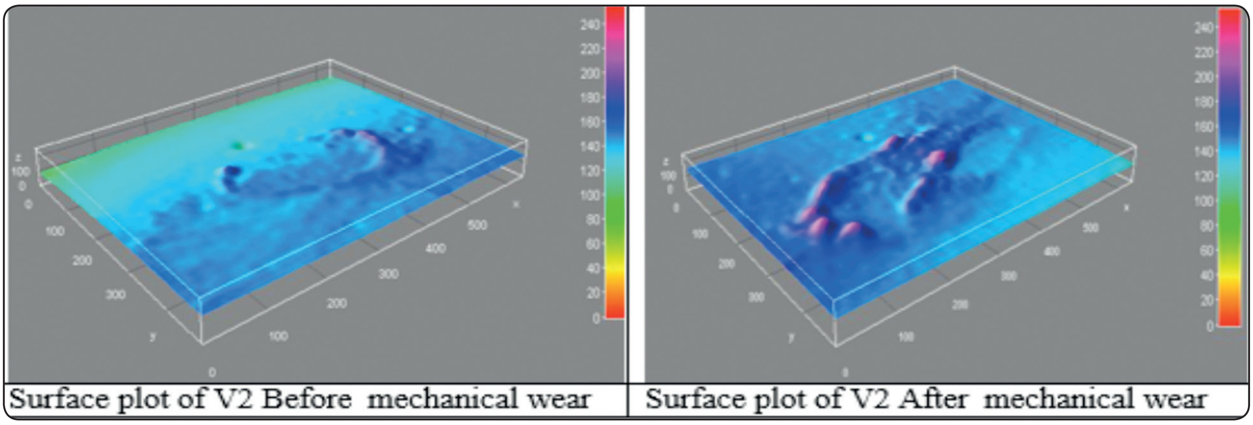

Fig (4): 3D IPM topographies

For **e.max occlusal veneers restoration;** it was found that the roughness mean value before wear was (0.2556±0.002Ra) while after wear simulation the roughness mean value was (0.254033±0.0014Ra) with roughness change mean value (-0.00157±0.0013 Ra)

The difference between groups was statistically non-significant as indicated by t-test ($t=1.2$, $p>0.05$)

Ra changes in Ceramic disc antagonist

For **v. enamic group Ceramic antagonist;** it was found that the roughness mean value before wear was (0.255±0.0001Ra) while after wear simulation the roughness mean value was (0.2563±0.0017Ra) with roughness change mean value (0.0013±0.0017Ra)

For **e.max group Ceramic antagonist;** it was found that the roughness mean value before wear was (0.2567±0.00013Ra) while after wear simulation the roughness mean value was (0.255167±0.00089Ra) with roughness change mean value (-0.00153±0.001Ra)

The difference between groups was statistically significant as indicated by t test ($t=2.3$, $p=0.037<0.05$)

TABLE (3) Roughness results (Mean values ±SD) for Occlusal veneers groups and ceramic antagonist before and after wear simulation

Variables		Occlusal veneers Ra		Ceramic antagonist Ra	
		Before	**After**	**Before**	**After**
vs. Cer. Antagonist	**v. enamic**	0.2599 ±0.0012	0.255367 ±0.004	0.255 ±0.0001	0.2563 ±0.0017
	e.max	0.2556 ±0.002	0.254033 ±0.0014	0.2567 ±0.00013	0.255167 ±0.0009

TABLE (4) Comparison of roughness change results (Mean values ±SD) between both Occlusal veneers groups and Ceramic antagonist after wear simulation

Variables		Occlusal veneers Ra changes	Antagonist Ra changes
		Mean±SD	Mean±SD
Ceramic vs. ceramic antagonist	v. enamic	-0.00453± 0.00039	0.0013± 0.0017
	e.max	-0.00157± 0.0013	-0.00153± 0.001
t-test	P value	0.2597ns	0.037*

****; significant (p<0.05)* *ns; non-significant (p>0.05)***

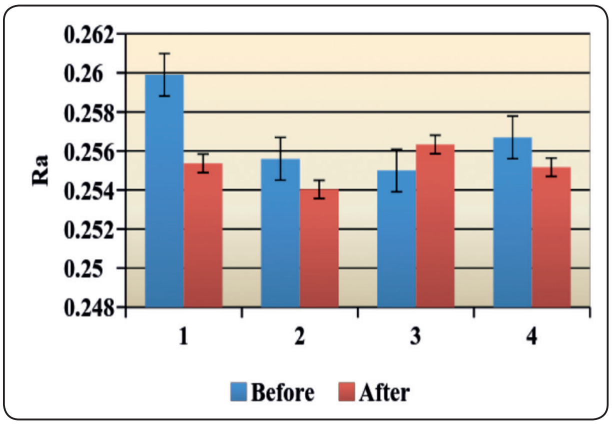

Fig. (5) Column chart showing Ra results mean values for Occlusal veneers groups and ceramic antagonist before and after wear simulation

Occlusal veneers ceramics restoration vs. enamel antagonist as shown in tables (5,6) and figure (6)

Ra changes in occlusal veneers ceramics restoration groups

For **v. enamic occlusal veneers ceramics group;** it was found that the roughness mean value before wear was (0.258733±0.003111Ra) while after wear simulation the roughness mean value was (0.255433±0.000444Ra) with roughness change mean value (-0.0033±0.002667Ra)

For **e.max occlusal veneers ceramics group;** it was found that the roughness mean value before wear was (0.2556±0.001933Ra) while after wear simulation the roughness mean value was (0.2537±0.000933Ra) with roughness change mean value (-0.0019±0.0012Ra)

The difference between groups was statistically non-significant as indicated by t-test ($t=0.87$, $p>0.05$)

Ra changes in enamel antagonist groups

For **v. enamic group Ceramic antagonist;** it was found that the roughness mean value before wear was (0.2565±0.000267Ra) while after wear simulation the roughness mean value was (0.2555±0.0008Ra) with roughness change mean value (-0.001±0.0008Ra)

For **e.max group enamel antagonist;**

it was found that the roughness mean value before wear was (0.256933±0.000111Ra) while after wear simulation the roughness mean value was (0.251933±0.000511Ra) with roughness change mean value (0.005±0.0006Ra)

The difference between groups was statistically significant as indicated by t-test ($t=5.3$, $p=0.037<0.05$)

TABLE (5) Roughness results (Mean values ±SD) for Occlusal veneers groups and ceramic antagonist before and after wear simulation

Variables		Occlusal veneers Ra		Enamel antagonist Ra	
		Before	After	Before	After
vs. Cer. Antagonist	v. enamic	0.258733±0.003111	0.255433±0.000444	0.2565±0.000267	0.2555±0.0008
	e.max	0.2556±0.001933	0.2537±0.000933	0.256933±0.000111	0.251933±0.000511

TABLE (6) Comparison of roughness change results (Mean values ±SD) between both Occlusal veneers groups and Ceramic antagonist after wear simulation

Variables		Occlusal veneers Ra changes	Antagonist Ra changes
		Mean±SD	Mean±SD
Ceramic vs. ceramic antagonist	v. enamic	-0.0033±0.002667	-0.001±0.0008
	e.max	-0.0019±0.0012	-0.005±0.0006
t-test	Pvalue	0.4159ns	0.006*

; significant (p<0.05) ns; non-significant (p>0.05)

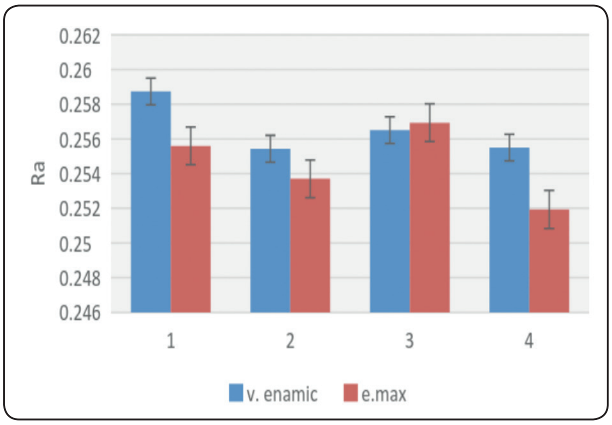

Fig. (6) Column chart showing Ra results mean values for occlusal veneers and enamel antagonist before and after wear simulation

Results of weight:

Weight changes in different groups: as shown in tables (7,8) and figure (7)

Occlusal veneers Material vs. ceramic antagonist

For **v. enamic group;** it was found that the weight mean value before wear was (1.163467±0.0004 gr) while after wear simulation the weight mean value was (1.1631±0.0001gr) with weight change mean value (-0.00037±0.00016gr)

For **e.max group;** it was found that the weight mean value before wear was (1.2265±0.0002 gr) while after wear simulation the weight mean value was (1.22033±0.00016 gr) with weight change mean value (-0.000617±0.0003gr). The difference between groups was statistically significant as indicated by t-test (t=30.5, p=<0.0001<0.05)

Weight changes in Ceramic antagonist groups

For **v. enamic group Ceramic antagonist;** it was found that the weight mean value before wear was (0.718867±0.0001gr) while after wear simulation the weight mean value was (0.7184±0.0003gr) with weight change mean value (-0.00047±0.0004gr)

For **e.max group Ceramic antagonist;** it was found that the weight mean value before wear was (0.4919±0.0002 gr) while after wear simulation the weight mean value was (0.4908±0.00013gr) with weight change mean value (-0.0011±0.00027gr)

The difference between groups was statistically significant as indicated by t-test (t=2.3 p=0.0293<0.05)

TABLE (7) Weight results (Mean values ±SD) for Occlusal veneers groups and ceramic antagonist before and after wear simulation

Variables		Occlusal veneers weight		Ceramic antagonist weight	
		Before	After	Before	After
vs. ceramic	v. enamic	1.163467±0.0004	1.1631±0.0001	0.718867±0.0001	0.7184±0.0003
	e.max	1.2265±0.0002	1.22033±0.00016	0.4919±0.0002	0.4908±0.00013

TABLE (8) Comparison of weight change results (Mean values ±SD) between both Occlusal veneers groups and Ceramic antagonist after wear simulation

Variables		Occlusal veneers **weight changes**	**Antagonist weight changes**
		Mean±SD	**Mean±SD**
vs. ceramic antagonist	**v. enamic**	-0.00037±0.0001	-0.00047±0.0004
	e.max	-0.000617±0.0003	-0.0011±0.00027
t-test	**P value**	<.0001*	0.0293*

; significant (p<0.05) ***ns; non-significant (p>0.05)***

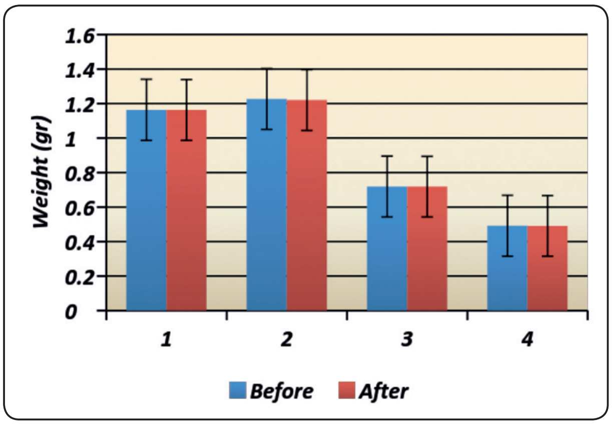

Fig. (7) Column chart showing weight results mean values for occlusal veneers and ceramic antagonist before and after wear simulation

Weight changes in all groups as shown in tables (9,10) and figure (8).

Weight changes in occlusal veneers restoration vs. enamel antagonist

For **v. enamic group;** it was found that the weight mean value before wear was (1.352667±0.0001gr) while after wear simulation the weight mean value was (1.351067±0.0002gr) with weight change mean value (-0.0016±0.00013gr)

For **e.max group;** it was found that the weight mean value before wear was (1.309133±0.0004gr) while after wear simulation the weight mean value was (1.309133±0.0004gr) with weight change mean value (0.000±0.000gr)

The difference between groups was statistically significant as indicated by t-test (t=9.8, p=<0.0001<0.05)

Weight changes in enamel antagonist groups for v. enamic group enamel antagonist; it was found that the weight mean value before wear was (0.473433±0.0001gr) while after wear simulation the weight mean value was (0.4732±0.00006 gr) with weight change mean value (-0.00023±0.00008gr)

For **e.max group enamel antagonist*;*** it was found that the weight mean value before wear was (0.390767±0.0003gr) while after wear simulation the weight mean value was (0.390133±0.0002gr) with weight change mean value (-0.00063±0.0001gr)

The difference between groups was statistically significant as indicated by t-test (t=5.1 p=0.002<0.05)

TABLE (9) Weight results (Mean values ±SD) for Occlusal veneers groups and ceramic antagonist before and after wear simulation

Variables		Occlusal veneers Ra		Ceramic antagonist Ra	
		Before	After	Before	After
vs. ceramic	v. enamic	1.352667±0.0001	1.351067±0.0002	0.473433±0.0001	0.4732±0.00006
	e.max	1.309133±0.0004	1.309133±0.0004	0.390767±0.0003	0.390133±0.0002

TABLE (10) Comparison of weight change results (Mean values ±SD) between both Occlusal veneers groups and Ceramic antagonist after wear simulation

Variables		Occlusal veneers groups weight changes	Antagonist weight changes
		Mean±SD	Mean±SD
vs. ceramic antagonist	v. enamic	-0.0016±0.00013	-0.00023±0.00008
	e.max	0.000±0.000	-0.00063±0.0001
t-test	P value	<.0001*	0.002*

; significant (p<0.05) ns; non-significant (p>0.05)

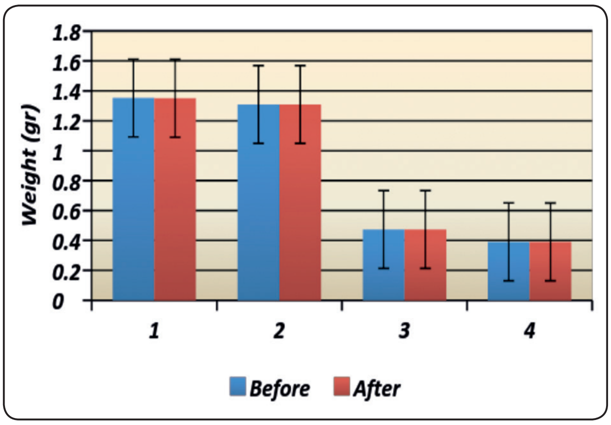

Fig. (8) Column chart showing weight results mean values for experimental and ceramic antagonist before and after wear simulation

DISCUSSION

Esthetic and adhesion are consider the main causes of failure of fixed prosthodontic restorations especially with the prafunctional habits patient.

Tooth wear process occurs when tooth come in contact with tooth, or restoration, and may be accelerated if the wear properties of restorations differ from those of the tooth structure.

Esthetic limitation of metal ceramic fixed prosthodontic restorations have because the lack of translucency affects in esthetic outcome. The Patient needs for a long-standing, retentive, highly strength fixed restorations, with the same degree of wear of enamel and best aesthetics properties are increased. Ceramics as fixed prosthodontic restorations have become widely used. However, due to ceramics abrasiveness to opposing enamel, recent types of hybrid ceramic fixed restorations can be used.

Trials for improvement the properties of composite resin materials as luting agent, still Continuous for the longevity of resin composite materials. Many attempts have been made to improve the flow and adhesive properties of these materials, including changes in heating temperature to increase the flow and decrease the viscosity of the material which in turn decrease the voids and enhance the bond strength of indirect restorations. [21]

Color mismatch or color change is one of the main causes of failures in ceramic veneer restorations. It was found that many variables could affect the final color stability of ceramic occlusal veneer restorations, including the thickness of the ceramic veneers, the thickness and color of the luting agents and the color of the underlying tooth structure (enamel and dentin layer) in addition to surface roughness.

Therefore, This study was to determine the effect of preheating of flowable composite material, as luting agent, and wear of two types of ceramic occlusal veneers restorations (vita enamic and e-max CAD/CAM) with different opposing surfaces (human enamel, vita enamic and e-max CAD/CAM) on the color stability of the vita enamic and e-max CAD/CAM posterior ceramic occlusal veneers.

In this study, teeth were standardize and symmetrically prepared, flat occlusal surface represent a clinical teeth wear were prepared, using a deep purple high speed diamond tapered dental stone (Komet USA), mounted to a milling machine (**NOUVAG** AF30 milling machine, Swizerland) perpendicular to the long axis of the teeth then the preparations were finished with the identically shaped finisher stone. This allow construction of occlusal veneer with proper contour and standardize occlusal cusp morphology. All line and point angles were rounded, the final thickness of constructed occlusal veneers were (1 mm at central fossa and 1.6mm at the cusp) and with selected shade (A2 HT for all IPS e.max CAD blocks (C14) and 2n2 HT for all CAD Vita enamic blocks (C14).in addition, A1 shad color of light polymerizing flow composite. Light-cured cements was preferred because of their color stability and their ability to control the working time. [36-42]

In This vitro study, the used parameters to measure the amount of the changes in color of ceramic occlusal veneers restoration were before and after cementation, before and after aging, and with heated and non-heated composite.

In addition, color changes of flowable composite resin luting agent was measured before, after heating, before, and after polymerization.

During polymerization, it is easier for the curing light to pass through the translucent ceramic materials than opaque ceramics. Therefore, in this study, the translucent occlusal veneer ceramic materials (vita enamic and e max) was used, with minimum available thicknesses to provide a high degree of conversion and indicate color changes in the luting agent. [38-39]

Neutral colors such as white, grey, and black define as colors that have no hue. Therefore, in current study, neutral white background was selected to minimize the effect of background hue on the color measurement of the restoration. [43, 44]

Different researchers' evaluated color with many methods, Color can be evaluated visually or instrumentally. In the current study, Spectrophotometer was used because they offer accuracy, standardization, numerical expression of color and Spectrophotometer when was compared to shade guide conventional methods has been shown to be superior in color matching. Therefore, Spectrophotometer was used in present study, for evaluation of color differences both quantitatively and objectively. The color expressed in L*, a*, b* coordinates. These obtained from spectral reflectance measurements using a spectrophotometer; provide a numerical description of the color position in three-dimensional color space. The L* color coordinate represents lightness; the a* color coordinate represents red on the positive axis and green on the negative; the b* color coordinate represents yellow (positive b*) and blue (negative b*). [36, 40, 42, 43, 45]

The results of current study showed that heating of composite cement causing noticeable effect of color change after cementation. It was found that composite resin cement heating affected color stability of e. max group non-significantly ($p=0.6801> 0.05$) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 5.6 < heated composite cement (ΔE) mean value = 5.12). And It was found that composite resin cement heating affected color stability of v. enamic group significantly ($p=0.003< 0.05$) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 5.7 > heated composite cement (ΔE) mean value = 3.9).

The effect of heating on the color of composite was studied before and after it was found that after heating, Composite resin recorded statistically non-significant ($p >0.05$) lower translucency before heating (79.93±4.5L) than after (82.37±1.02L) with translucency change mean value (2.4 ΔL) .Negative sign means become darker and Positive sign means become lighter .

Composite resin recorded statistically non-significant ($p >0.05$) lower chroma before heating (-0.9±1.1a) than after (-0.8±1.8 a) with change mean value (0.067 Δa) .Positive sign means become reddish and Negative sign means become greenish.

Composite recorded statistically non-significant ($p >0.05$) lower chroma before heating (5.967±2.18b) than after (6.2±4.6 b) with change mean value (0.23 Δb). Positive sign means become yellowish and Negative sign means become bluish

In this study, it was found that total color change mean value of composite resin luting agents (before and after heating) recorded (3.8± 1.6ΔE). Many authors suggested an extended visual rating scale (EVRS) was considered an average difference of up to (3.7 ΔE) acceptable in the oral cavity, because there is difficulty in controlling light conditions. Where: ΔE 0 Description: Excellent esthetics with accurate color choice, not being clinically perceived, or only with great difficulty. ΔE 2 Description: Very slight difference in color, with very good aesthetics. ΔE 4 Description: Obvious difference, but with an average acceptable to most patients, ΔE

6 Description: Poor aesthetics, but within the limits of acceptability. ΔE 8 Description: Aesthetics are very poor and unacceptable to most patients and ΔE 10 Description: Aesthetics are totally unacceptable. In addition, to relate the amount of color change (ΔE *) to a clinical environment, the data were converted to National Bureau of Standards (NBS) units11 as follows; (NBS units = ΔE x 0.92). [46]

Koksal and Dikbas quantified the color changes by NBS units (National Bureau Standard) where critical Marks of Color Change between (0.0-0.5 trace)extremely slight change, (0.5-1.5 slight) slight change,(1.5-3.0 Noticeable) perceivable change, (3.0-6.0 Appreciable) Marked change, (6.0-12.0 Mush) Extremely Marked change and(12.0+ very much) change to other color.

In this study, the color difference values obtained between baseline groups and after cementation using heated and non-heated composite and between baseline and after mechanical wearing of occlusal veneers. it was found that total effect of heating of composite resin cement; regardless to material groups or mechanical wearing, composite cement heating affected color stability significantly ($p=0.00095 < 0.05$) as indicated three way ANOVA test where (non-heated composite cement (ΔE) mean value = 5.94 > heated composite cement (ΔE) mean value = 4.53).

According to Vichi and others, a minimal effect of the shade of a cement on the final color of a restoration, which might be instrumentally detectable but clinically not relevant. [47]

From results of this study, It was found that v. enamic group that cemented with Non-heated composite resin; recorded statistically non-significant ($p=0.9287 > 0.05$) higher color change mean value (5.71±1.18ΔE) than e.max group (5.60±1.17ΔE) as indicated by un-paired t-test. And it was found that e.max group that cemented with heated composite resin recorded statistically non-significant ($p=0.2491> 0.05$) higher color change mean value (5.12±1.09ΔE) than v. enamic group (3.94±1.05ΔE) as indicated by un-paired t-test

Wear is one of a major problem that may occur physiologically or pathologically in the in oral cavity causes loss of the original anatomical form of hard tissue resulting in unacceptable damage to the occluding surfaces that affect the functional path of masticatory movement and esthetics. Therefore, the wear of enamel and restorative material is a one of the critical concern when selecting a restorative material for any clinical restorative treatment. Some authors found that the selection of a restorative material that replaces enamel should have wear characteristics similar to enamel, and the proper selection of restorative materials is important to preserve function, esthetics and occlusal harmony. [48-49]

Many factors can be affect the wear of the occlusal restoration as: the percentage of filler particles, the hardness, the size of the surface, and the degree of polymer resin matrix conversion, the interaction between the matrix and the particles, applied force and the sliding distance. The composition of the Filler particles in the restorations play an important role in the wear resistance [50- 54]

Wear using chewing simulator may provide an indication of the clinical performance of occlusal veneers when associated with different opposing as counter body, restricting the involved variables. In vivo, measurement and comparison of wear is problematic due to variations in mastication forces, eating habits, parafunctional habits, and also from patient to patient. Thus, in this study the wear of ceramics with different materials against different ceramic restorations and human enamel were investigated ; using a specific simulator wear machine. A simulator machine was developed in an effort to simulate the wear manner that occurs in the mouth with masticatory parameters included an occlusal force, stroke length and total number of strokes.

In this study Chewing simulator Robota are thermo mechanical aging has become a reliable method of simulation of oral conditions for a relatively long service time. In present study, two-bodied wear was measured, and the test was repeated 37,500 times to clinically simulate the 3 months chewing condition. The color changes and wear was measured by weight and surface roughness.

Many authors reported that, color alteration occurs in the first 300 hours of the aging process, as the composite's water sorption stops with the saturation and stabilization of the polymeric chains. [38, 55 - 56]

In this study, the effect of mechanical wear, slight changes occur compared to the baseline group. it was found that total effect of mechanical wearing; irrespective of material groups or composite cement heating, it was found that mechanical wearing simulator affected color stability non-significantly ($p=0.5776> 0.05$) as indicated three way ANOVA test where (After mechanical wearing (ΔE) mean value = 5.38 ≥ before mechanical wearing (ΔE) mean value = 5.09)

It was found that the effect of mechanical wear on cemented e.max group with non-heated composite resin; recorded statistically non-significant ($p=0.7019> 0.05$) higher color change mean value ($6.44\pm0.85\Delta E$) than v. enamic group ($6.03\pm1.18\Delta E$) as indicated by un-paired t-test. and it was found that the effect of mechanical wearing on cemented e.max group with heated composite resin; recorded statistically non-significant ($p=0.7409> 0.05$) higher color change mean value ($4.62\pm0.52\Delta E$) than v. enamic group ($4.43\pm0.75\Delta E$) as indicated by unpaired t-test.

It was found that mechanical wear affected on e. max group composite resin cement heating affected color stability significantly ($p=0.045< 0.05$) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 6.4 > heated composite cement (ΔE) mean value = 4.6). And v. enamic group It was found that composite resin cement heating affected color stability significantly ($p=0.047< 0.05$) as indicated by t-test where (non-heated composite cement (ΔE) mean value = 6.03 > heated composite cement (ΔE) mean value = 4.4)

In the current study, it showed that there was color shift among the different groups, produced by artificial thermo mechanical aging, may be due to the different in composition of the ceramic materials and the difference in the technical fabrication procedure that was followed, in accordance with the manufacturers' recommendations. vita enamic ceramic group showed amount of color change with a ΔE^* and the amount of color change more than the limit of clinical acceptability, because the resin content of these vita enamic ceramic blocks. according to Nikzad et al and Paravina et al (2012and 2004) [57,58] they explained that although great improvement , cross-linked and fully cured of resin ceramic ,by it may have suffered chemical disassociation which activated the intrinsic color shift. also the vita enamic ceramic restorations due to the high resin content which may be damaged by the high sintering and glazing temperatures. So the manufacturer recommendation is that should only be polished and become ready to be used.

In the e max ceramic groups, after the artificial thermo mechanical aging, a slight and insignificant color change below the clinical acceptability was occurred, according to Pires-de-Souza et al(2009)[59] may be due to breakdown of the metal oxide content of the colorants added to the ceramic itself, or due to the ceramic coloring liquid used to give the ceramic its suitable shade match. The breakdown of metal oxides is followed by peroxide compound formation that would likely change the color of the shaded ceramic material. The manufacturers' recommendations for e max ceramic blocks are sintering and glazing because the blocks are fully sintered, to give the material its final strength and characterization.

Hamza et al (2017) [10] concluded that surface roughness of resin nano ceramic affected significantly by artificial accelerated aging, while its color stability, did not affect.

In different studies, Wear were measured by surface roughness, loss of weight, loss of vertical height, wear track depth, loss of volume. In this study, wear of enamel was measured using two methods: weight loss and degree of surface roughness whish affect loss of surface height.

Measurements of surface roughness using quantitative analysis of two-body wear e. max and vita enamic occlusal veneers restorations and their antagonists (enamel, e max and vita-enamic discs) was carried out before and after loading in a 3D-surface analyzer system optically. it Indicated that Ra changes in v. enamic occlusal veneers ceramics restoration groups vs. enamel antagonist before wear and after wear simulation , the roughness mean value was (-0.0033±0.002667Ra) and for enamel antagonist; it was found that the roughness mean value was (-0.001±0.0008Ra). While e.max occlusal veneers ceramics group vs. enamel antagonist before wear and after wear simulation the roughness mean value was (-0.0019±0.0012Ra) and for enamel antagonist; roughness change mean value was (-0.005±0.0006Ra). The difference between occlusal veneers ceramics restoration groups vs. enamel antagonist groups was statistically non-significant as indicated by t-test (t=0.87, p>0.05), and the difference between enamel antagonist groups was statistically significant as indicated by t-test (t=5.3, p=0.037<0.05).

For Ra changes in occlusal veneers ceramics restoration group's vs. Ceramic antagonist, it was found that, the roughness mean value of v. enamic occlusal veneers group; was (-0.00453±0.00039 Ra) . Moreover, for e. max occlusal veneers group; roughness change mean value was (-0.00157±0.0013 Ra), with the difference between groups was statistically non-significant as indicated by t-test (t=1.2, p>0.05).

While Ra changes mean value for v. enamic group Ceramic antagonist was (0.0013±0.0017Ra) and for e. max group Ceramic antagonist was (-0.00153±0.001Ra) with the difference between groups was statistically significant as indicated by t test (t=2.3, p=0.037<0.05).

According to previous studies, there is no significant correlation between the restoration hardness and the degree of wear of antagonistic teeth. They found that, the degree of wear more affected by the surface structure and the roughness of the restorations or environmental factors. [60-62]

According to others, Many factors causes the lower-fusing ceramics to be kinder to enamel: smaller crystal size, decrease in crystalline phases, lower concentration of crystal phase, homogenous dense structure, have decreased leucite content, The finer grain size of the lower-fusing porcelains and the decrease in crystalline phases, makes these porcelains more polisher. [2, 4, 23–25].

Weight loss was used in this study to measure the degree of wear of two groups of occlusal veneers and different opposing surfaces including enamel, v. enamic and e.max. It was found that the weight change mean value of v. enamic group occlusal veneers material vs. ceramic antagonist (e.max disc) was (-0.00037±0.00016gr) and for e. max group; was (-0.000617±0.0003gr) with difference between groups was statistically significant as indicated by t-test (t=30.5, p=<0.0001<0.05). In addition, the weight changes in Ceramic antagonist groups for v. enamic group Ceramic antagonist; was (-0.00047±0.0004gr) and for e.max group Ceramic antagonist; was (-0.0011±0.00027gr) with difference between groups was statistically significant as indicated by t-test (t=2.3 p=0.0293<0.05).

Moreover, it was found that v. enamic group Occlusal veneers group vs. enamel antagonist weight was (-0.0016±0.00013gr) and for e.max group; was (0.000±0.000gr) with the difference between groups was statistically significant as indicated by t-test (t=9.8, p=<0.0001<0.05).

Moreover, Weight changes in enamel antagonist groups for v. enamic group enamel antagonist; was (-0.00023±0.00008gr) and for e.max group enamel antagonist; was (-0.00063±0.0001gr) with difference between groups was statistically significant as indicated by t-test (t=5.1 p=0.002<0.05).

These results indicate that weight loss of v. enamic occlusal veneers restoration vs. enamel antagonist was more than e.max occlusal veneers restoration vs. v. enamel antagonist. In addition, the weight loss of enamel antagonist vs. v. enamic occlusal veneers group was more than weight loss of enamel antagonist vs. e.max occlusal veneers restoration

Jung et al reported that, the degree of wear of the antagonistic enamel was lower in harder but softer materials than dental porcelain. In addition, more wear was shown in the polished group with glazing than in the polished group. This is attributed to the addition of porcelain composite in the glazing process.[60]

DeLong et al. reported that on dental porcelain wear, 300,000 chewing cycles a volume loss was 0.162 ± 0.057 mm^3. Moreover, Feldspathic dental porcelain volume loss was 0.119 ± 0.059 mm^3 in 240,000 chewing cycles[62]

Vita Enamic, The hybrid ceramic, both the ceramic network structure and the reinforcing polymer network structure are merged fully with one another. The dual ceramic-polymer network is comprised of a structure-sintered ceramic matrix, the pores of which are filled with a polymer material .it consists of 86 wt % inorganic ceramic, and 14 wt% organic polymer.

Ceramic restorations causing wear of opposing enamel and the abrasiveness of the materials are determined by the smoothness. Wear occur, due to friction developed by mechanical interlocking between the two wear bodies. Low-fusing porcelain incorporate fine leucite crystals in low concentrations. Therefore, causes less abrasive to opposing enamel, recent studies are showing lower enamel wear and others showing no difference .[61,63-68]

In present study, the unprepared enamel of premolar cusps was placed against glazed occlusal veneer restorations. According to previous study that compared the wear of opposing enamel with various restorative materials. These included gold, glazed, and polished or glazed-only Finesse and IPS Empress. They found that glazed-and-polished Finesse, and glazed-and-polished all Ceram were the least abrasive, where glazed-only IPS Empress was the most abrasive. [67]

Numerous factors related with enamel wear: microstructure, the physical properties and surface characteristics of ceramic restorations. ceramic fixed restorations, causes extreme wear of opposite enamel, in addition to its low fracture resistance. However, there is no evidence to show that in vitro wear testing can expect the amount or form of clinical wear of enamel caused by ceramic prostheses. [61,69]

Other researchers studied the materials and the antagonist wear of the same material. They found that the results were affected by the test parameters: amount of force, number of cycles, frequency of cycles, and number of samples. They found that placing of the unprepared enamel of molar cusps against glazed crowns seems to be the most suitable method to evaluate a ceramic material with regard to antagonist wear. [70]

Therefore, additional researches on vita enamic resin ceramics and e max ceramic are needed to study their capability to long standing oral conditions with stable color and surface characterization. Different thermo mechanical periods, different forces, different opposing materials with different occlusal habits may be required, in comparing these materials under controlled situations to predict performance clinically.

CONCLUSION

According to the results of this study within its limitations, it can be concluded that:

1. Heated flowable composite used for cementation of e-max CAD or Enamic occlusal veneers results in significantly less color stability than un-heated flowable composite. The of color change above the level of perceptibility, indicating that it was perceivable to the human eye, and below the level of clinical acceptability.

2. There is no significant difference between e-max and Enamic occlusal veneers in their color stability

3. Occlusal wear of e. max recorded non-significant higher color change than v. enamic group for Non-heated flowable composite resin while e. max group recorded non-significant higher color change than v. enamic group for Heated flowable composite resin

4- Mechanical wear recorded higher effect on enamel surface antagonist vita enamic group than enamel antagonist e.max group

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