Color Stability and Surface Roughness of Different Composite Resins after Using Different Polishing Systems.

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Background and objectives: To evaluate and compare the color stability and surface roughness of different composite resins after using different polishing systems and then submitting to accelerating artificial aging (AAA) and staining by black tea.

Method: Twenty disk-shaped specimens (were compacted into the custom-made cylindrical plastic mold that had an internal diameter of 10 mm and a depth of 2 mm) were prepared for each composite resin type (3M Z350, tokoyama palfique and shofu Beautifil II) for a total of 60 specimens, Each composite group was divided into two subgroups according to the polishing system (n=10) (Shofu super-snap polishing disks and Eve Diacomp Plus Twist wheel). Color parameters (L*, a*, and b*) and surface roughness were measured before and after accelerating artificial aging (2000-4000 thermal cycle) and staining.

Results: It was observed that all resin-based materials showed an increase in color change value and surface roughness values after 2000 thermal cycles. while after 4000 thermal cycle only the surface roughness value decreased in all resin-based materials.

Conclusion: all resin-based materials showed clinically acceptable color stability ($\Delta E < 3.7$) and surface roughness >)0.2 µm) after (2000 thermal cycle) and staining.

Keywords: color stability, surface roughness, thermal cycle, staining.

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INTRODUCTION

Tooth-colored restorations due to resin composites have been widely used in comparison with metallic restorations even for posterior teeth with relative success. Patients have defined resin composites as the choice material for aesthetic restorations. Because of its excellent initial aesthetics, high cost compared to other restorations, and adhesion to tooth structure. However, due to the intrinsic properties of this type of material, they are prone to staining and wear. [1] Surface roughness is the major contributor to extrinsic discoloration of resin composite restorations. This property is closely related to the organic matrix, inorganic filler composition of the composite, and finishing and polishing procedures. A rough surface greater than 0.2 µm provides higher chances of biofilm accumulation, leading to staining and discoloration of the restoration's body or margins. [2] The Composite resin discoloration may occur in three ways: (I) extrinsic discoloration due to biofilm accumulation on the restoration surface; (II) surface or subsurface changes with slight penetration and reaction of dye agents on the superficial layer of composite resin; (III) intrinsic discoloration due to physic-chemical reactions inside the body of the restoration. [3] Similarly, the matrix structure as well as the features of inorganic fillers have a direct effect on the surface smoothness of composite resin restorations and on the staining ability.

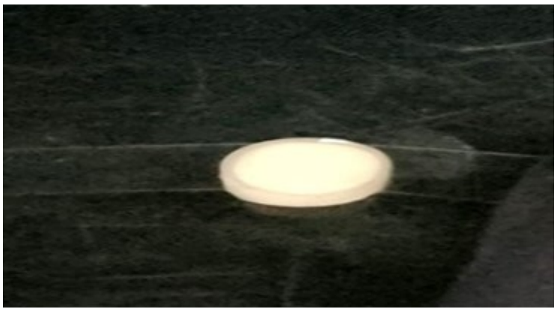
Hydrophilic matrices are more susceptible to water absorption, dye penetration, and staining than hydrophobic ones. Moreover, the filler type and size (glass, proven silicon, and others) are also closely related to staining.[4] In order to measure objectively the color alterations on composite resin restorations, some methods have been experienced, during mastication, wear leads to the dislodgment of filler particles. Due to dislodged particles, holes are present on the surface of restoration exposing the organic matrix to oral environment. In addition, these dislodged particles might cause more abrasion to the restoration. Also, the larger and harder the filler, the more wear and degradation might be observed. [5] Nanotechnology has recently been used in composite resin production. The new material represents an evolution on a balance of aesthetics and mechanical properties, allowing them to be used in anterior and posterior restorations. Among the advantages of using this material, the following can be pointed out: lower polymerization shrinkage, improved mechanical properties greater, better color stability, brightness, surface smoothness, favored optical behavior, and decreased wear. [6,7] However, not only the material type and composition are responsible for maintaining the smoothness but also the finishing and polishing procedures. The procedures require a sequential use of less abrasive instruments, favoring a smooth and bright surface. [8] In order to carry out those procedures, some sets of highly flexible discs polyurethane-based and impregnated with aluminum oxide have been used. [9] Recently, abrasive silicon rubbers have been marketed in order to provide a smooth and bright surface on composite resins. However, there is no consensus in the literature concerning the effectiveness of different finishing and polishing procedures and systems used to finish and polish composite resins. Some studies have demonstrated that the main procedure to reach adequate smoothness on composite resin surfaces using multilayered burs before the use of discs or abrasive rubbers. [10] The tested hypothesis in the present study is that composite resin with different filler types submitted to different types of polishing procedures produces different results of surface roughness and staining. The objective was to evaluate the effect of the polishing procedures (1) the color stability and (2) the surface roughness of a nano-filled and a microhybrid composite resin submitted to storage in tea solution for 7 days.

MATERIAL AND METHOD

Specimens Preparation: In this study three different light-polymerizing composite resins (Shade A1) used ; these were Nanofilled Filtek Z350 XT (3M ESPE, St. Paul, MN, USA), PALFIQUE LX5 Supra-Nano Spherical Fillers (Tokoyama, Tokyo, Japan) and Beautifil II Dental Hybrid Composite (Nanohybrid ,shofu). The total sample number decided to be studied in this research was sixty (n= 60). Every twenty specimens were isolated for each type of composite resin (n=20). Consequently, each composite group was divided into two subgroups according to the polishing system (n=10). The samples were prepared in a cylindrical plastic mold that had a diameter of 10 mm and a depth of 2 mm and placed on glass slab covered with clear strip (Mylar strip) and pressed, it was stable on the glass slab due to thickness of mixt (Figure 1).

Figure 1: Cylindrical plastic mold that had a diameter of 10 mm and a depth of 2 mm placed on a glass slab.

The materials were manipulated and polymerized according to the manufacturers' instructions. All specimens were polymerize by an LED light-curing unit (R&S,flexi light,France) with a light intensity of 1000



mW/cm2, and exposure to the top and bottom surfaces was 10 sec for each specimen.light output was monitored with a hand held radiometer after each polymerization process of each sample. After sample preparation the smooth surface that made during applying clear strip band removed by extra fine finishing diamond bure. Upon completion of the sample preparation The whole prepared samples were stored for 24 hours in distilled water at 37° C. [11]

Polishing process

Two polishing systems Shofu super-snap polishing disks (Shofu Inc., Kyoto, Japan) and spiral polishing system (Eve Diacomp Plus Twist, EVE Ernst Vetter, Germany) were used in this study. Each finishing and polishing systems was employed solely for the subgroups sample. In the first group a Shofu super-snap polishing disks were used from coarse to super fine, were sequentially applied in a mounted low-speed handpiece under 10,000 rpm speed and 40g pressure each for 15 seconds, with no water cooling. [12] Low-speed handpiece was attached to a special arm on the surveyor with constant RPM (10,000) (Figure 2). On the contrary, in the second group diamond impregnated two-stage spiral polishing system (EVE Diacomp Plus Twist, EVE Ernst Vetter GmbH; Pforzheim, Germany) was used. Pink and grey polishing wheels were sequentially applied in a mounted low-speed handpiece under 10,000 rpm speed and 40g pressure for 15 seconds for each wheel. [13] (low speed handpiece attached to a special arm on the surveyor with constant RPM for controlling the pressure). The whole prepared samples were stored for 24 hours in distilled water at 37°C.

Measurements

Basically the specimens are coded at the

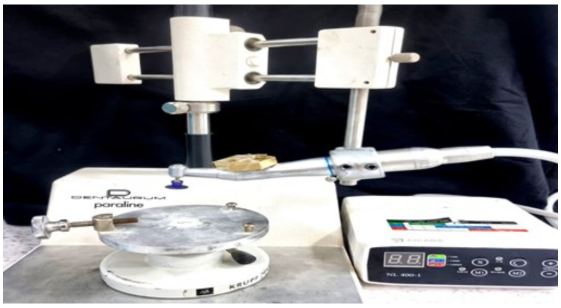


Figure 2: low-speed handpiece attached to a special arm on the surveyor with constant RPM for controlling the pressure.

back surface of specimens by numbering .as well as different properties (color stability and Surface roughness) of the experimental group were measured after polishing and before thermocycling and staining these measurements will be considered the baseline data as follow.

Color stability

To assess shade changes, the Commission Internationale de l'Éclairage (CIE) L*, a*, and b* color coordinates were evaluated by using a dental spectrophotometer VITA Easyshade compact (Brea, CA, USA, Vident) (Figure3).

Figure 3:Dental spectrophotometer (VITA Easyshade compact).

The included software automatically quantified the data, giving the red-green (a*) and yellow-blue (b*) axis values and brightness (value, L*). This enables mathematical comparison between the colors of specimens before and after different thermocycling aging and staining. Through The color difference (ΔE) formula $\Delta E = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$ was used, the color difference (ΔE) is determined at the center of each specimen. Each measure-

ment was repeated three times against the white background only and the average was taken for further analysis. [14] the VITA Easyshade compact was calibrated before each measurement. (CIE) L*a*b* values of each specimen measured and light source illumination was corresponding with average daylight (D65). [15]

Surface Roughness Evaluation

Surface roughness (Ra) of the specimens is evaluated by profilometer (Talysurf 10, R.P.I.LTD., Leiceter, England, U.K) , Ra values of each specimen were obtained by three measurements on the three different axes passing through the center of the specimens polished surface. The profilometer was calibrated before each measurement. The most commonly used instrument was a diamond stylus which traveled in a straight line along the surface (the probe tip could run parallel to the specimen's polished surface in a horizontal plane). The average surface roughness measurements for the prepared samples were expressed and calculated as Ra (µm) value (which is universally recognized as the international parameter for roughness, namely, is a measure of the arithmetic mean of the absolute departures of the roughness profile from the mean (horizontal) line).[16]

Thermocycling

After the first measurements which were after polishing (baseline data), all the specimens were subjected to thermal aging using a thermocycling device. The aging cycles were conducted was 2000 and 4000 thermocycler with a dwell time of 30 sec (5-55°C) [20]. After a 2000 thermal cycle, the specimens were removed from the distilled water, dried with paper towels, and put inside tea for 7 days, and then the second measurement was taken for both color stability and surface roughness, Then after that, the second thermal cycle was started to another 2000 thermal cycles that mean total cycles of specimens were 4000 cycle then were put in tea for another 7 days then the third measurement was taken for both color stability and surface roughness. Total measurements were three times, first measurements after the polishing, second and third measurements after the first thermocycling and staining, and the second cycle of thermocycling and staining. A comparison of the collected data is estimated.

Staining procedure

After each thermocycling, the samples were dipped in tea as a beverage The tea solution was the choice as it is one of the most consumed drinks in Kurdistan region and worldwide. used 2 g of prefabricated tea bag (Jihan tea) immersed in 100 mL of boiling water for 5 minutes. The period of immersion was standardized to 7 days (24h per day) Every day, samples were replenished to avoid contamination by yeast or bacteria. [12] After staining the specimens were removed from a closed container and then washed and dried with paper towels Before the color and surface roughness were measured.

Statistical analysis: IBM SPSS 26 was used. Analysis of variables within the same group was carried out using the analysis of variance (ANOVA). Statistical analysis for comparing the variables between the study groups was carried out using the t-test for two independent samples. The level of significance was set at $*P < 0.05$.

RESULTS

surface Roughness: Table 1 shows the descriptive statistics for all three composite resin types using both approaches of polishing Shofu Super-Snap polishing Disks (Disk) and Eve Diacomp Plus Twist (Spiral) at three levels of thermocycling names (Baseline, 2000 and 4000 thermocycling), and it explores that the thermocycling operation had an impact on the values of surface roughness in all three composite resins types using both polishing methods. In 3m ESPE type while using Shofu Super-Snap polishing Disks for polishing, the mean value before the thermocycling stage was 0.058 µm, but the process used to evaluate the changes provided a different perspective, and the values increased to 0.092 µm after 2000 cycling and then decreased to even the baseline with 0.052 µm after applying 4000 thermocycling. However, using Eve Diacomp Plus Twist for polishing, the same effect was seen with 0.078 µm in baseline, and then a significant change was noticed

Table 1: Mean and standard deviation of surface roughness dimension

Groups	Methods	Levels		
		Baseline	After 2000 Thermocycling+staining	After 4000 Thermocycling+staining
		Mean ± SD	Mean ± SD	Mean ± SD
Filtek Z350 XT (3m ESPE)	Shofu Super-Snap Polishing Disks	0.058 ± 0.015	0.092 ± 0.053	0.052 ± 0.027
	Eve Diacomp Plus Twist	0.078 ± 0.013	0.109 ± 0.067	0.078 ± 0.020
PALFIQUE LX5 (Tokoyama)	Shofu Super-Snap Polishing Disks	0.059 ± 0.014	0.133 ± 0.223	0.074 ± 0.019
	Eve Diacomp Plus Twist	0.066 ± 0.017	0.081 ± 0.016	0.076 ± 0.016
Beautiful II Dental (Shofu)	Shofu Super-Snap Polishing Disks	0.156 ± 0.107	0.119 ± 0.023	0.102 ± 0.019
	Eve Diacomp Plus Twist	0.166 ± 0.018	0.196 ± 0.041	0.171 ± 0.016

with 0.109 µm after the first thermal cycling, it then dropped down to baseline again.

Likewise, in Tokoyama ceramic kind, again both polishing approaches had an influence on changing the surface roughness of the materials with 0.059 µm and 0.066 µm before starting the thermal cycling process, then the surface was changed much more in Disks with 0.133 µm than in Spiral with only 0.081 µm after rounding 2000 thermal. Nevertheless, 4000 thermal cycling stage did not ruin the surface and based on the results, it turned back to close to its original values with 0.074 µm and 0.076 µm mean values for Disks and Spiral polishing technique respectively.

To identify if the thermal cyclic procedures effectiveness was significantly different on composite resins types by using the same polishing material. One-Way-ANOVA test was implemented and according to the findings in Table 2, it indicated that there was only no statistically significant difference between the composite resins' types at 2000 thermocycling with Disks polish method where p-value (0.785) was larger than 0.05 significant level, while the rest turned out to be significant. Furthermore, Bonferroni pairwise comparison test was used, stating that all three levels for both polishing techniques, no statistically significant difference was reported between ESPE and Tokoyoma and their surface roughness values were almost identical. On the other hand, except in Disk polish type usage and after 2000 thermocycling processing where there was no statistical difference reported between all three ceramic types, the remaining pairwise tests were found to be significantly different.

Color Stability Results: In addition to the study's objectives, color stability was also considered and measured at three different levels of thermal cyclic operation for all three composite resins and polishing techniques were also considered. As an overview, Table 3 displays the mean and standard deviation values of all three dimensions used to measure the materials colors and looking at L value, it was found that after applying 2000 thermocycling and staining, the value decreased in average by 2% and then even down warded more by about 4% after 4000 thermocycling+ staining. Almost all color dimensions were affected by the thermal cyclic process and the changes were varied due to the polishing type usage as well as composite resin as seen in Table 3.

Table 2: One-way ANOVA test between composite types for each measurements for both polishing approaches

Method	Levels	F	P-Value	Pairwise Comparison
Shofu Super-Snap Apolish-ing Disks	Baseline	7.991	0.002	Sig. diff (ESPE & Shofu, Sho-fu & Tokoyoma)
	After 2000 Thermal	0.245	0.785	No statistically significant different among the ceramic types
	After 4000 Thermal	13.269	0.000	Sig. diff (ESPE & Shofu, Shofu & Tokoyoma)
Eve Diacomp Plus Twist	Baseline	114.526	0.000	Sig. diff (ESPE & Shofu, Shofu & Tokoyoma)
	After 2000 Thermal	16.707	0.000	Sig. diff (ESPE & Shofu, Shofu & Tokoyoma)
	After 4000 Thermal	98.895	0.000	Sig. diff (ESPE & Shofu, Shofu & Tokoyoma)

ΔE was also calculated between before and after the first stage of thermocycling+staining , before and after the second thermal cycle, as shown in Table 4. It is worth noting that the means of ΔEs were all greater than one and thus visible to human eyes. According to the professional's point of view, ΔE value greater than 3.7 is clinically unacceptable and from the below findings, no ΔE figures beyond the threshold value were noticed between baseline and 2000 thermocycling+staining stage of for all groups. However, Tokyoma as well as Shofu composites using both polishing methods were greater than the threshold value after 4000 thermal cyclic operation. It was necessary to report that 3m ESPE was less affected using spiral polish in terms of color stability with mean value 1.608, followed by 1.715 from the same composite resin ΔE value calculated for baseline and after 2000 thermocycling+staining. Furthermore, the color of this composite resin was still acceptable even after 4000 thermocycling+staining with a mean of ΔE value 2.926 as well as 3.209 for disk and spiral polishing respectively. On the other hand, the other two composite resin Tokoyoma and Shofu were highly affected by 4000 thermal cyclic stage and staining, where none of the ΔE values were found to be acceptable.

Table 3: Mean and standard deviation of L, A and B against the white background color per stages

Groups	Polishing Methods	Color Parameters	Levels		
			Baseline	After 2000 Thermocycling+staining	After 4000 Thermo cycling+staining
			Mean ± SD	Mean ± SD	Mean ± SD
Filtek Z350 XT (3m ESPE)	Shofu Super-Snap Polishing Disks	L	82.650 ± 0.897	81.430 ± 1.118	79.910 ± 0.705
		A	0.290 ± 0.152	0.500 ± 0.302	0.610 ± 0.661
		B	18.200 ± 0.710	19.120 ± 1.054	18.150 ± 1.223
	Eve Diacomp Plus Twist	L	80.860 ± 0.425	79.570 ± 0.406	77.850 ± 0.453
		A	-0.540 ± 0.070	-0.210 ± 0.137	0.160 ± 0.126
		B	16.660 ± 0.306	17.500 ± 0.403	17.450 ± 0.440
PALFIQUE LX5 (Tokoyama)	Shofu Super-Snap Polishing Disks	L	81.370 ± 1.207	79.050 ± 1.087	76.000 ± 0.992
		A	-0.130 ± 0.216	-0.010 ± 0.367	0.340 ± 0.357
		B	9.530 ± 0.574	10.390 ± 0.852	10.210 ± 0.963
	Eve Diacomp Plus Twist	L	82.280 ± 1.733	73.600 ± 23.087	77.430 ± 1.512
		A	-0.090 ± 0.242	0.220 ± 0.469	0.910 ± 0.489
		B	9.900 ± 0.469	10.750 ± 1.486	11.130 ± 1.673
Beautiful II Dental (Shofu)	Shofu Super-Snap Polishing Disks	L	84.370 ± 0.960	81.720 ± 0.928	77.650 ± 0.848
		A	3.350 ± 0.165	3.440 ± 0.430	3.750 ± 0.303
		B	23.456 ± 0.637	23.460 ± 1.358	23.990 ± 1.197
	Eve Diacomp Plus Twist	L	84.090 ± 0.651	82.120 ± 0.670	79.690 ± 1.884
		A	3.110 ± 0.277	2.910 ± 0.213	3.240 ± 0.291
		B	23.110 ± 0.582	22.760 ± 1.046	23.400 ± 1.196

Table 4: Mean, standard deviation and paired samples t-test analysis

Composite resins	Polishing Methods	ΔE (Baseline-After 2000 Thermocycling+ staining)	ΔE (Baseline-After 4000 Thermocycling+ staining)	Difference	Paired T-Test	
		Mean ± SD	Mean ± SD	Mean ± SD	T Value	P-Value
Filtek Z350 XT (3m ESPE)	Shofu Super-Snap Polishing Disks	1.715 ± 0.433	2.926 ± 0.512	1.211 ± 0.652	5.874	0.000
	Eve Diacomp Plus Twist	1.608 ± 0.445	3.209 ± 0.518	1.601 ± 0.417	12.137	0.000
PALFIQUE LX5 (Tokoyama)	Shofu Super-Snap Polishing Disks	2.546 ± 0.679	5.478 ± 1.761	2.932 ± 1.407	6.59	0.000
	Eve Diacomp Plus Twist	1.857 ± 1.181	5.213 ± 0.853	3.356 ± 0.761	13.946	0.000
Beautiful II Dental (Shofu)	Shofu Super-Snap Polishing Disks	2.998 ± 0.688	6.892 ± 0.788	3.894 ± 0.535	23.003	0.000
	Eve Diacomp Plus Twist	2.254 ± 0.725	4.586 ± 1.947	2.333 ± 1.488	4.956	0.000

DISCUSSION

The demand on esthetic restorations is increasing owing to the need for esthetic solutions and preserving tooth structure by avoiding indirect restorations. Although these direct formulations have properties such as translucency, good shade matching, and shade variety in order to blend with tooth structure, multiple factors can affect the color stability of these resin composite formulations, including the type of resin matrix as well as type, size, and amount of fillers , Resin formulations containing nano -sized particles are the materials of choice for direct esthetic applications due to superior optical properties and high polish ability potential compared to nano hybrid composites. [21]

The smaller the size of the filler, the more surface smoothness can be achieved after the polishing process. [22] Although there are multiple finishing and polishing options available, in the current investigation, we used two polishing system (super snap shofu disks and EVE diacomp twist) and the time of application on the top of the specimen standardized the polishing in order to compare surface roughness values across the different resin composite brands. Further, the utilization profilometer provided more reliable surface topography measurements. [23]

previous study showed that thermal cycling significantly affected the surface texture of composites with dislodgement of filler particles this was in disagreement with our study.[24] However, a correlation between thermocycling and clinical longevity of dental composites is difficult due to the varied cycles number, different temperatures, dwell time and intervals between baths used in the studies.

Therefore, the larger fillers of Beautiful II resulted in a rougher surface compared to the other composites, as the filler particles exposed at its surface after degradation are coarser, leading to a higher Ra value, another aggravating factor that might have

affected the surface roughness of Beautifil II is its high water sorption compared to other nanofilled resin composites.[25]
This was in agreement with the study by Itanto et al, who concluded their study by The surface roughness of a nanofilled composite resin after polishing with a multi-step technique is better than that of a nanohybrid composite resin.[26]
all composite resins that were polished by Super Snap polishing systems, before and after 2000 cycle of thermocycling the lower value of surface roughness was observed than EVE Diacomp Plus TWIST polishing systems, This was in agreement with the study by Balbina et al. who reported that using abrasive disks impregnated with aluminum oxide presented a better performance in reducing the surface roughness of resin composites. [27] the flexibility of the material used for polishing, with this being reinforced by the study of Alfawaz, who reported that the surface roughness varies according to the polishing system and resin composite used. [28] but in term of color change we found that after 2000 cycle of thermocycling and staining, all composite resins that were polished by EVE Diacomp Plus TWIST polishing systems showed less color change in comparison with Super Snap polishing systems.
The finishing and polishing of composite resin restoration are necessary stages and provide better clinical outcomes, A high degree of surface roughness can cause plaque accumulation, gingival irritation, and caries. [29] In this study, all of the surface roughness values that contained two polishing systems(befor and after 2000 thermal cycle and 4000 thermal cycle) were lower than 0.2 µm,which is the critical size for bacterial adhesion , These values are in agreement with the surface quality standard ISO 1302:2002.[30] Monomer matrix strongly impacts the polymerization, physical, and mechanical in dental composites. Ozdasa et al. reported weaker bond between the resin matrix and filler particles, and the consequent microcracks or interfacial gaps produced between the matrix and filler enable for stain penetration and discoloration of composite restorations because of water absorption and so can absorb other fluids such as dyes, tea, and coffee. In this study, coffee, coco cola, and red wine were used representing beverages commonly consumed in an oral environment all containing water. [27]
Composites containing hydrophilic components, like TEGDMA or TEGMA as a matrix component, may be more susceptible to matrix degradation,because they allow water to penetrate more easily due to its hydrophobicity.[24] like Beautifil II (nohybrid) composite resin,which contains more TEGMA as a matrix component than others. Regarding the color change after the 2000 thermocycling and staining procedures for 7 days, color change of all composite resins were accepted clinically because the value of color change was below 3.7 which is over than it unacceptable clinically, ΔE value of 3.7 or less is considered to be clinically acceptable. [29] In this study, after thermocycling and staining ΔE value of nanofilled and nanohybride composite resin were lower than 3.7, it's result was acceptable clinically . This finding is in accordance with Gönülol and Yılmaz, In the present study, there was a statistically significant correlation between surface roughness and color change. Previous studies have reported that, besides material composition, the finishing and polishing procedures might also influence composite resin surface quality, and that rough surfaces exhibit high staining. The structure of a resin composite resin and the characteristics of particles have a direct impact on surface smoothness and susceptibility to extrinsic staining. [21]
In this study, after polishing, thermocycling and staining, ΔE value of nano-hybride composite resin increased , beside its roughness surface maybe due to the filler contents of nano-hybride resin were lower than other resins, resin matrix contents increased. Therefore, it was seemed that absorption of stains increased. So Staining susceptibility of composites is not related to surface roughness alone, it is related to the volume and size of fillers. Increased filler size and filler content resulted in decrease of organic matrix. So, the amounts of color change were lower. And after 4000 cycle of thermocycling followed by staining for 7 days, surface roughness value of all composite resins decreased but the lowest value of surface roughness was ob-

served in Filtek Z350 followed by Palfique LX5 then Beautifil II, and the surface roughness value of all composite resins accepted clinically because the value was below the threshold of roughness ,were lower than 0.2 µm, because over than 0.2 µm is the critical size for bacterial adhesion, and those decreasing of surface roughness could be due to the composition of material, including the type of organic matrix, could be more relevant to maintenance of roughness over time than general behavior of particles fillers. This was in agreement with the study by Dos Santos et al. [31]

Also was in agreement with the study by Yilmaz and Sadeler. [32] was in disagreement with the study by Fidan and Dereli [33].Regarding the color change after the 4000 thermocycling and staining procedures for 7 days, color change of all composite resins increased in comparison to the value of 2000 thermocycling were unaccepted clinically because the value of color change was over than 3.7 which is over than it unacceptable clinically, except for Filtek Z350 which was ΔE value lower than 3.7 is considered to be clinically acceptable. [34] In this study, after 4000 thermocycling and staining ΔE value of Palfique LX5 (nanofilled) and Beautifil II (nanohybride) composite resin were over than 3.7, it's result was unacceptable color change.

CONCLUSION

All resin-based materials showed an increase in color change(ΔEs) value and surface roughness values after 2000 thermal cycles.but after 4000 thermal cycles the surface roughness value decreased in all types of composite resins, types of the organic matrix, could be more relevant to the maintenance of roughness over time than the general behavior of particles fillers.

Filtek Z350 XT that polished by a super snap polishing disk showed the best composite resin in terms of color stability and surface roughness.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest relevant to this article.

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