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COMPARING THE EFFECT OF DELAYED FINISHING AND POLISHING ON COLOR STABILITY OF TWO TYPES OF COMPOSITE FINISHING WITH ONE STEP POLISHING SYSTEM

Sana Saideh[1], Aziz Abdullah[2]
1 MA student, Dep. Of Restorative dentistry, Tishreen university, Latakia, Syria
2 Head, Dep. Of Restorative dentistry, Tishreen university, Latakia, Syria

ABSTRACT:

The aim of this study was to evaluate the effect of delayed finishing and polishing on color stability of two types of composite (filtek Z250, filtek bulk fill posterior). Thirty blocks of each composite type were prepared using a metallic matrix**.**After curing, bulk fill and Z250 specimens were divided into three subgroups according to finishing time (direct, after 5 minutes, after 24h). ΔE was calculated with vita easy shade at base line and one week after storage in coffee solution. The results showed that color stability of bulk fill composites was not affected by delayed finishing and polishing. While Z250 specimens that were finished after 24 h showed significantly higher color change than specimens that were finished and polished immediately or 5 minutes later. Bulk fill specimens showed significantly higher color change than Z250 specimens except for specimens that were finished and polished after 24 h which showed no significant difference between bulk fill and Z250 composites.

Key words: delayed finishing, bulk fill composite, color stability

INTRODUCTION

The clinical use of composite resins has been rapidly increased over the past few years as a result of increased aesthetic demand by patient [1-5]. Esthetic restorative materials should duplicate the appearance of a natural tooth, and failure or success of the restoration depends primary on color match and color stability of the material. The structure of the resin matrix and characteristics of the filler particles have a direct influence on the surface property like smoothness [6-8] and susceptibility to extrinsic staining [9-12].

Many factors affect the resin's affinity for extrinsic stains like its conversion rate and physico-chemical characteristics such as water sorption rate [10-13]. surface roughness and surface integrity, polishing technique also affect stainability of composite resins .On the other hand, intrinsic factors involve the discoloration of the resin material itself due to oxidation of the resin matrix and of the interface of the matrix and filers .Thus, color stability of composite is influenced by the photoinitiator systems, resin matrix and filler loading.[13-26]

Intrinsic factors cause irreversible discoloration, while the discoloration caused by extrinsic factors like adsorption of dyes or plaque can be easily removed by polishing [27-30]

*Corresponding Author Address: Dr. Sana Saideh E-mail: sanaahasan25@gmail.com

The proper finishing and polishing should be applied to enhance the esthetics and longevity of dental restorations. Failure of restoration that caused by plaque accumulation, discoloration, wear and the esthetic is highly influenced by the surface texture of dental materials [23,31-34].

Finishing and polishing procedures are important to achieve the desired surface which require the sequential use of instrumentation, generally with gradually smaller grained abrasives [18]

A set of highly flexible finishing and polishing discs with polyurethane-based and abrasive particles of aluminum oxide disks were widely used for polishing resin composite restorations for years.[35-38]

Newly "one-step" polishing systems like diamond polishers and silicone synthetic rubbers have been introduced to reduce the steps and the clinical time spent to finish a restoration. The use of one step polishers aims to achieve a smooth surface within a minimum period of time using a single instrument. [39,40]

Generally, resin based materials should be placed in 2 mm increments as manufactures recommendations, in order to obtain sufficient light transmittance and complete curing of composite resins [26]. Although placing the resin in 2 mm increments reduces the polymerization shrinkage, but it may increase voids incorporation between the layers [6]. It is also a time consuming procedure when applying composite resins in an incremental technique and light curing each increment individually, and there is an increasing possibility of moisture contamination between individual resin composite restorations [33]. Recently, bulk-fill composite resins are introduced to overcome such fallibility . Manufactures claimed that these materials can be sufficiently light cured up to 4 mm in a single increment, without influencing the polymerization shrinkage, degree of conversion, or cavity adaptation [16]. with lower polymerization shrinkage when compared to conventional composite resins. [9]

Differences in physical properties, surface characteristics and polishability are expected when using different composite materials, which could affect longevity of the restoration.

The time elapsed before finishing and polishing process is also responsible for affecting the physical properties [19], and may increase the possibility of early failure when the restoration is polished before achieving adequate polymerization [36-28]

The objective of the current study was to determine the influence of immediate and delayed finishing and polishing on color stability of bulk fill and conventional composite

MATERIALS AND METHODS

Sixty specimens measuring 8 mm diameter and 3mm in thickness were

made using a metallic mold fixed to a holder with a mylar strip between mold and holder. Two types of composites were used in this study (table 1)

Composite	**3M ESPE Filtek z250, shade A2**	**3M ESPE Filtek bulk fill posterior,shade A2**
Resin matrix	BIS-GMA, UDMA, BIS-EMA	AUDMA,AFM,DDDMA,UDMA
Filler content	zirconia/silica The particle size distribution is 0.01µm to 3.5µm with an average particle size of 0.6µm.	Zerconia20nm, silica4-11nm, Zerconia silica cluster YbF3 100nm
	82% by weight **68**% by volume	76.5% By weight 58.4 % by volume

Table 1

The composite was lightly condensed into the mold using a plastic instrument. Bulk fill specimens were applied in bulk and cured while Z250 specimens were applied and cured in 2 layers for Z250 specimens. composite resin was cured for 20 second through a glass slide and a mylar strip and for 20 second after removal of the glass slide. The end of the light guide was in contact with the glass slide to standardize the distance between the light source and the specimens.

Specimens were divided into three subgroups for each restorative material. the first group were finished and polished immediately after curing. the second group was finished and polished after 5 minutes. the third group was finished and polished after 24 hour.

specimens were finished using a diamond bur on a high speed hand piece fixed to a holder which can only move in one way against fixed specimens to ensure that a flat surface will be achieved. Then specimens were polished using one step polishing disks from optimize (TDV -Brazil) a silicon rubber disc with aluminum oxide and metal abrasive particles . polishing procedures were applied with heavy pressure followed by light pressure to attain brightness at low speed to avoid over heating. baseline color measurements for all specimens were recorded with vita easy shade compact, USA, before exposure to the staining agents. all the measurements were made at the center of each specimen against a white back ground. Three readings were taken for each specimen.

The staining solution used in this study was 3,6 g of coffee dissolved in 300 ml of boiling distilled water. each group was stored in coffee for 7 days. Then, specimens were rinsed with water for 1 minute and dried with absorbent paper and three measurements were recorded for each specimen. color testing was

carried out according to the CIE-Lab-color system Values were recorded using the Commission International de l' Eclairage L*a*b color system [39]. The CIE (Commission International de l' Eclairage) system uses the three dimensionless colorimetric measurements. L* characterizes the lightness of the color and can be ranged between 0 (dark) and 100 (light); a* defining a color on a red-green axis; and b*describing the blue part of the color. For each sample, three repeated measurements were taken to determine the colorimetric values. measurements were automatically calculated by colorimeter and recorded. The total color using the following equation: ΔE* = ([Δ *L**] 2 + [Δ *a**] 2 + [Δ *b**] 2)1/2

Statistical analysis:

SPSS V 16 was used for statistical analysis . ANOVA test was used to compare the effect of three finishing time on color stability for both composites .T-student test was used to compare color stability of both composites.

RESULTS

Colmogrov-smirnov test was employed to ensure that data follow normal distribution depending on composite type and finishing time.

Results showed p value higher than 0,05 for all specimens. as a result, data followed standard normal distribution and standard statistical tests will be obtained to compare composite color stability at three finishing times

Color stability of bulk fill composite was not affected by delayed finishing and polishing since p value was higher than 0.05 as shown in table 2, but it was less than 0,05 for Z250 composite which means a significant difference between the three finishing times (table 3). LSD test was performed to determine the differences between these three subgroups.

As a result, there was no significant difference between direct finishing and polishing or 5 minutes delayed for Z250 specimens. while delayed finishing for 24 hour caused greater color change compared with immediate finishing and polishing and 5minutes delay. { P (direct-after 5 min)=0.27 , P(direct-after 24 h)= 0.06,P(after 5 min, after 24 h)= 0.0001}.

T-student test for uncorrelated samples was performed to compare color stability of bulk fill and Z250 composites. Color change was significantly higher when finishing and polishing performed immediately or delayed for 5 minutes as shown in table 4 and 5 .and there was no significant difference between bulk fill and Z250 composites when finishing and polishing procedures were delayed for 24hour (table 6).

DISCUSSION

Color stability of dental restorations is one of the most important characteristics of composite resin materials in terms of longevity [3]. Although there have been several studies on the effect of different drinks on the color stability of resin composites,

there is little information about color stability of a new bulk-fill resin composite, which has been introduced for applying in thicker layers Still, there are no publications that address the effect of delayed finishing and polishing on color stability of bulk fill and conventional composite.

The finishing and polishing procedures applied may affect the quality of composite surface and can therefore be related to early discoloration of the resin based materials [12].

Recently, different one-step polishing systems were introduced to reduce the steps and time necessary to polish resin composites.

optimize one step polishers were chosen in this study because its composition which contain aluminum oxide. Van Dijken and Ruyter (1987) showed that the capability of aluminum oxide discs to produce a smooth surface was related to their ability to cut the filler particle and matrix equally [37].

Coffee was chosen as the storage media in this study because of its frequent use in daily life. Various instruments can be used to evaluate Discoloration of dental materials. The use of these instruments aims to eliminate the subjective interpretation of visual color comparison, spectrophotometers and colorimeters have been used to measure color change in dental materials [13,14,15,24,26,30]

The Vita Easy Shade system was chosen for use in this study for its facilities in optical color measuring. The CIE Lab system was chosen to record color differences because it is well suited to determine small color differences,[37-19] It is also commonly used in dentistry because L*, a*, and b* are evenly distributed in a perceptual color space[20]

The best time for initial finishing and polishing remains a common controversy. While some manufacturers claim that finishing and polishing should be done directly after curing or five minutes later, several authors have suggested that its better if these procedures were delayed for 24 hours [2] .

In this study, Z250 specimens showed lower color stability when finishing and polishing procedures were delayed for 24 hour comparing to specimens with direct finishing or 5 minutes delay. These results could be predictable because composite polymerization reaction would not be complete prior to 24 hours and, water sorption would still be occurring, which could result in hygroscopic expansion of composites [7] and reduction in surface properties [8,22].

Excessive water absorption can decrease the life of a composite resin by plasticizing and expanding the resin component resulting in microcracks formation. These microcracks or interfacial gaps at the interface between the filer and matrix allow stain

penetration and discoloration [4] During finishing and polishing operations, filler particles might be plucked out leaving voids with different volumes depending on composite type.

Color stability of bulk fill composite was not affected by delayed polishing. This result could be related to its filler system which is similar to filtek supreme (a nano hybrid composite). It has been reported that in nanohybrids , smaller particles were shaved off and smaller voids were left on the surface.[35]

Z250 composite showed higher color stability compared to bulk fill composite with direct finishing and polishing or 5minutes delay. This could be related to different factors like filler proportion (76,5% by weight in bulk fill composite ,82% in Z250 composite) it has been reported that color stability increased in composites with higher filler proportion [27]. other factor which could affect color stability in bulk fill composite is ytterbium trifluoride (a component in its filler system) with high water sorption rate [25]

The resin system of Filtek Z250 was also responsible of its high color stability. The majority of TEG-DMA , a somewhat hydrophilic monomer, has been replaced with a blend of UDMA and bis-EMA which impart a greater hydrophobicity to the resin composite.

As a result the low water sorption rate stemming from the use of hydrophobic resin system might be responsible for the high stain resistance capability of Z250 composite. [11]

Results of this study were similar to those found by Sayna S hamszadeh et al 2016 which demonstrated that bulk-fil composite resin had greater color susceptibility after immersion in coffee than conventional composites. they demonstrated that greater staining susceptibility of thicker specimens might be due to their lower depth of cure when placing bulk-fil materials. [31]

These results were in agreements with Ali Essam Abdelnabi*, and Nermeen Kamal Hamza 2016. no significant differences in color stability were obsereved between bulk fill and conventional flowable composite. these differences might be due to their use of flowable composite [1].

CONCLUSION

Z250 composite showed higher color stability than bulk fill composite in specimens that were finished immediately and after 5 minutes. Delayed finishing and polishing for 24 h caused decrease in color stability of Z250 composite, while bulk fill composite was not affected by delayed finishing and polishing.

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TABLES:

Finishing time for bulk fill composite	sample	Mean	Standard deviation	ANOVA test value	P value
Direct	10	7.11	1.44	0.164	0.85
After 5 minutes	10	7.25	1.35		
After 24 hour	10	6.94	0.97		

Table 2: results of ANOVA test for comparison the three finishing times of bulk fill composite

Finishing time for Z250 composite	sample	Mean	Standard deviation	ANOVA test value	P value
Direct	10	4.63	0.91	9.01	0.001
After 5 minutes	10	4.08	1.32		
After 24 hour	10	6.13	1.06		

Table 3: ANOVA test for comparison the three finishing times of Z250 composite

Composite type	Sample	Mean	Standard deviation	T-Student test value	p-value
Bulk fill	10	7.11	1.44	4.59	0.0001
Z250	10	4.63	0.91		

Table 4: T-Student test for comparison bulk fill and Z250 composites with immediate finishing and polishing

Composite type	sample	mean	Standard deviation	T-Student value	P-value
Bulk-Fill	10	7.25	1.35	5.29	0.0001
Z250	10	4.08	1.32		

Table 5: T-Student test for comparison bulk fill and Z250 composites When finishing and polishing procedures were delayed for 5 minutes

Composite type	Sample	mean	Standard deviation	T-Student test value	p-value
Bulk-Fill	10	6.94	0.79	1.93	0.69
Z250	10	6.13	1.06		

Table 6: T-Student test for comparison bulk fill and Z250 composites when finishing and polishing procedures were delayed for 24 hour