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ASSESSMENT OF CERAMIC REPRESSING EFFECT ON COLOR AND TRANSLUCENCY OF PRESSABLE CERAMIC MATERIALS

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ABSTRACT

Aim: This study aimed to determine the repressing impact of Celtra and GC with varying weight percentages on color, translucency using the spectrophotometer, and the effect of immersion in different types of media of ceramic discs.

Materials and Methods: Sixty ceramic disc-shaped samples were constructed by heat pressing technique. All samples were split into two groups based on the kind of ceramic material. Group G :GC lisi press , and Group C: Celtra press . then split up into five subgroups based on the repressing weight percentage into : 100% new, 75% new and 25% repressed ceramic, 50% new and 50% repressed ceramic, 25% new and 75% repressed ceramic,100% repressed ceramic. Further, each subgroup samples were classified into two classes according to the immersion solution, Class L: lemon juice, Class T: green tea All samples subjected to measure the translucency and color change before and after immersion.

Results: Ceramic type, and Immersion medium had a statistically significant impact on mean Change in color, repressing wight percentage had no statistically significant impact on mean ΔE, repressing weight percentage, immersion, and immersion medium had a statistically significant impact on mean translucency parameter (TP). There was a statistically significant difference between the mean TP of different repressing weight percentages. Green tea indicated statistically significantly less mean TP than lemon juice.

Conclusion: Ceramic type and immersion medium had a significant effect on both color and translucency, the mix of new ingot with repressed ceramic are in the clinical acceptance range as regard ΔE.

KEYWORDS: Ceramic Repressing, Color, Translucency, Pressable Ceramic Materials

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INTRODUCTION

The utilization of dental ceramics has gained significant traction due to their remarkable mechanical qualities, biocompatibility, and aesthetic appeal, which allows them to replicate the appearance of genuine teeth. Dental ceramics have a wide range of uses because of their qualities. Some examples are crowns, partial coverage restorations, full arch bridges, three-unit bridges, and denture teeth[1].

One of the most popular methods for creating glass-ceramic dental restorations is heat pressing. Apart from its ease of use, the heat pressing method enhances the crystalline dispersion in the glass matrix, reduces porosity, and improves marginal accuracy when compared to alternative methods[2].

We used two commercially pressable glass ceramic materials; GC Initial® LiSi Press: is a high-strength lithium desilicated ingot with proprietary HDM (High Density Micronization) technology that equally disperses micro-crystals—rather than traditional larger-size crystals—to fill the entire glass matrix, resulting in excellent physical properties and aesthetics. It has a biaxial flexural strength of >500MPa and virtually no reaction layer when divested. And Celtra, which is the new generation of high strength glass ceramics, zirconia reinforced lithium silicate – ZLS, high strength pressable glass ceramics.

In order to mimic the color of natural teeth, pressable glass-ceramics are offered in ingots with varying hues and transparency. With the help of a pneumatic press furnace, these ingots are forced into a mold. The sprues containing the button and residual material are removed once they are cooled. Though it has been noted that certain dental facilities recycle these materials, these buttons should ideally be thrown away. It has been questioned if these materials' mechanical characteristics or microstructure could be affected by repeated processing (repressing)[3, 4].

Dental ceramics' surfaces deteriorate when exposed to aqueous solutions, PH variations, change in temperature and this can lead to undesirable effects on the restoration, including microbial plaque accumulation and color stainability. As the acidic agents of the beverage might dissolve elements in ceramics due to their chelating effect, that affect both optical behavior and appearance of ceramics. Lemon juice and green tea were selected due to their high popularity in our daily diet and they are known to have the potential to stain dental restorations. Lemon juice has an acidic contents with PH = (2:3), green tea with PH= (8:10) that causes discoloration to all ceramic restorations, that acids can decalcify the tooth structure[5].

Color change ΔE values are established based on three parameters: ΔL^* which is the variation in lightness or darkness, Δa^* which is the variation in the hue along the red/green scale, Δb^* which is the change in the hue along the yellow/ blue scale. Different ΔE values below 3.7 units are considered matched in the oral environment, according to some research[2].

Ceramics are susceptible to discoloration that may be extrinsic factors discoloration include staining by adsorption or absorption of colorants as a result of contamination from various exogenous sources[6,7]. Thus, dietary habits such as large consumption of soft drinks and beverages can also contribute to the staining of the ceramic discs.

Kotb S., and Shalaby MM. (2020) examined the impact of re-pressing lithium disilicate ceramic with various weight percentages on color, translucency, and bond strength with veneering material. They fabricated and categorized thirty discs based on the weight percentage of newly pressed and repressed ceramic. Group 1 comprised 100% new ceramics, while Group 2 consisted of 75% new and 25% re-pressed ceramic. In Group 3, the samples were 50% new and 50% re-pressed ceramic, whereas Group 4 contained 25% new and 75% repressed ceramic.

Group 5 exclusively comprised 100% re-pressed discs. They used one sample from each group for (SEM) testing, and the remaining discs in each group (5 samples) for color and translucency measurements before being veneered with porcelain for shear bond strength testing. The results showed that ΔE of the tested groups were in the clinical accepted range except the 100% re-pressed group. Also, the results showed that there was no significant difference between all tested groups as related to translucency. Finally, there was a significant difference between the 100% re-pressed group and the 25% new + 75% re-pressed group.

Saber AY. et al., (2023) evaluated the effect of repeated heat-pressing and thermo-mechanical fatigue on color and translucency of lithium disilicate glass ceramic crowns. They prepared a freshly extracted human maxillary right 1st premolar according to standardized preparation for all-ceramic crown restoration. They duplicated the preparation to produce thirty epoxy resin dies. They divided the resin dies into three groups (n=10), according to the number of heat-pressings of IPS e.max Press used for crowns construction. They found that IPS e.max Press showed no statistically significant color change after repressing and thermo-mechanical fatigue. Regarding translucency, IPS e.max Press showed no statistically significant difference in translucency after repressing, however, there was a statistically significant decrease in translucency after thermo-mechanical fatigue.

MATERIALS AND METHODS

1- Samples Grouping:

Sixty ceramic disc-shaped samples were constructed (10m.m diameter, 1.5m.m thickness) by heat pressing technique. All samples were split into two groups based on the kind of ceramic material. **Group G:** GC lisi press (n= 30), and **Group C:** Celtra press (n= 30). Each group was separated into five subgroups. (n= 6) based on the repressing weight percentage into **(sub group 1)**: 100% new, **(sub group 2)**: 75% new and 25% repressed ceramic, **(sub group 3)**: 50% new and 50% repressed ceramic, **(sub group 4)**: 25% new and 75% repressed ceramic, **(sub group 5)**: 100% repressed ceramic. Further, each subgroup samples were randomly selected and classified into two classes according to the immersion solution; **Class L**: lemon juice, **Class T**: green tea.

2- Samples Preparation

A Teflon mold and Teflon ring were used. The discs' dimensions were standardized through the usage of the mold. The diameter and thickness of the mold were 10 mm and 1.5 mm, respectively. In order to secure the two portions of the initial split Teflon mold, the Teflon ring was positioned. Pressed discs were manufactured by employing heat-pressing and lost-wax processes. Blue inlay wax was dipped until completely filled into the lower portion of the Teflon mold. Two minutes were given for the wax to cool. Then, the Teflon ring was eliminated, and the wax disc was extracted by separating the two components. This process was repeated 59 times in order to obtain 60 wax discs.

The wax patterns were all identically sprued using 3mm sprue wax then placed on a specially designed cylindrical crucible former. The casting rings were lined with casting ring liner and sprayed with surface tension reducing agent. The ring was filled with investment material Phosphate-bonded investment material that mixed in line with the manufacturer's guidelines.

The investment material was mixed for 2.5 minutes in a vacuum mixer. The silicon ring was placed on the ring base with caution to prevent any deformation of the wax objects. When the investment material filled the investment ring to the marking of the of the silicon ring, with no air trapped in the material. The filled investment ring was permitted to prepare for 35 minutes according to the manufacturer instructions. Subsequently, the casting rings were positioned in a burn out furnace with a top temperature of 850 C for wax elimination. Before finishing the preheating cycle of the investment ring, the press furnace was preheated in compliance with the manufacturer's guidelines of each material (Celtra and GC). Upon the completion of the preheating cycle, the investment ring was promptly extracted from the preheating furnace as which the time wasn't exceed 1 minute at most to prevent too much cooling down of the investment ring. The recommended pressing programs for Celtra Press and GC lisi press were selected according to the size of investment ring. The cylindrical opening of the mold was filled with a prefabricated ingot of Celtra press and GC lisi press. After the end of the pressing cycle, the investment ring was eliminated from the press furnace using investment ring tongs and placed on a cooling grid to cool down. Upon reaching room temperature, the acquired ceramic samples were discarded through sandblasting machine[8] using 150 μm alumina particles at 3 bar pressure for three minutes and cleaned in an ultrasonic bath cleaner for 15 min and the white reaction layer was carefully removed. The naked eye was unable to detect any porosity or other casting flaws. Sprues and button parts were sectioned using a water-cooled low-speed diamond saw.

A sensitive digital scale was used to weigh the button pieces, sprues, and pressed discs after they were pressed. Using purified water and an ultrasonic cleaner, all of the discs were polished and cleaned. Glazing was applied to the samples based on the type of material. According to the manufacturer, the suggested glaze firing cycle, known as "Power Fire," raises the Celtra Press restoration's flexural strength to a maximum of more than 500 MPa.

As controls, the pressed samples were utilized. The sprues and buttons were split off the first pressed discs and the buttons were then tailored through grinding with air abrasion using 150 μm alumina particles at 3 bar pressure to facilitate their placement into the refractory mold to fabricate the samples by repeated heat-pressing using the same procedure as for pressed samples. In each pressing cycle, each ceramic material was positioned in accordance with the intended Wt% between new ingots and pressed ingot leftovers. After pressing and repressing, all samples were finished and glazed based on the manufacturer's recommendations of each material.

3-Immersion procedure:

All ceramic samples of each subgroup (n=6) were submerged in the solutions for (12 successive days) at 37° C, simulating 1 year of clinical service. Green tea (lipton) was prepared according to manufacturer's recommendations; 1.8 g of green tea was added to 150 ml of boiling water. Acidic juice was obtained from lemon juice syrup (Healthy). Ceramic discs were immersed into labelled containers containing 20 ml of each b (solutions and discs kept in an incubator at 37°C for 12 days[8]. Solutions were renewed every 48 hours, and each disc was rinsed with running water before immersion in the new freshly prepared solution. Twice daily, the solutions were agitated throughout the whole experimental time (12 days). At the end of the immersion time, discs were rinsed with running water then ultrasonically cleaned in distilled water and dried.

4-Color and Translucency parameters measurements

All disc samples were exposed to color and translucency measurement before immersion by recording the color parameters (value, chroma, hue) were measured using a spectrophotometer (X-Rite, model RM200QC, Neu-Isenburg, Germany). The values were expressed in the CIELAB (Commission International de l'Eclairage L*a*b*) color space where color was recorded in three-color parameters a, b, L. a: indicates greenness when minus, and redness when plus. b: indicates a value of plus for yellowness, zero for neutrality, and minus for blueness. L: It characterizes the achromatic nature of color by quantifying its lightness; one hundred was denoted as white and zero was as black. Color measurements were calculated before and after immersion. Using the equation, ΔE was calculated as the overall color difference between the discs before and after immersion:

$$\Delta E = ([\Delta L^*]^2 + [\Delta a^*]^2 + [\Delta b^*]^2)^{½}$$

Where:

ΔL =L before immersion – L after immersion

Δb = b before immersion – b after immersion

Δa = a before immersion – a after immersion

The translucency parameter for all the discs before immersion were measured using spectrophotometer. Utilizing the contrast ratio (CR) or the translucency parameter (TP), the translucency of aesthetic restorative materials has been assessed traditionally. The specimen was placed over a white backdrop, and its color difference over a black background was calculated to determine the TP. A high TP score indicates low opacity and high translucency. The instrument was operated in accordance with the CIE L*a*b* color scale in relation to the CIE standard illuminant D65, which the International Commission on Illumination defines as average day light. Next, each disc's translucency parameter was determined by applying the following equation to determine the disc's difference when it was in contrast to a white background and a black background:

Tp= ((Lb*-Lw*)2+(ab*aw*)2+(bb*bw*)2)1/2 ()

L*: refers to lightness.

a*: refers to redness to greenness.

b*: refers to yellowness to blueness

Statistical analysis

Statistical analysis was done by SPSS v23 (Armonk, NY: IBM Corp). Mean and standard deviation (SD) values were employed to present the data. Utilizing the Three-way ANOVA test and repeated measurements, the results were collated and statistically examined. When comparing two groups of data when the ANOVA test is significant, Bonferroni's post-hoc test is performed after the ANOVA test. A significance level of <0.05 for a two-tailed P value was applied.

RESULTS

Color change test

The findings indicated that ceramic type (irrespective of repressing weight percentage and immersion medium) demonstrated a statistically significant impact on mean ΔE (P-value <0.001, Effect size = 0.436). Mixing percentage (irrespective of ceramic type and immersion medium) shown no statistically significant impact on mean ΔE (P-value = 0.100, Effect size = 0.091). Immersion medium (irrespective of ceramic type and mixing percentage) demonstrated a statistically significant impact on mean ΔE (P-value <0.001, Effect size = 0.591). The mean ΔE was not statistically significantly affected by the interaction between the factors (P-value = 0.999, Effect size = 0.001). As there was no statistically significant interaction between the variables, it may be concluded that they are all independent of one another.

Translucency test

The findings indicated that ceramic type (irrespective of repressing weight percentage, immersion and immersion medium) demonstrated a statistically significant impact on mean TP (P-value <0.001, Effect size = 0.742). Repressing weight percentage (regardless of ceramic type, immersion and immersion medium) yielded a statistically significant impact on mean TP (P-value <0.001, Effect size = 0.818). Immersion (irrespective of ceramic type, repressing weight percentage and immersion medium) demonstrated a statistically significant impact on mean TP (P-value <0.001, TABLE (1). Three-way ANOVA results for the effect of different variables on mean ΔE

Source of variation	Type III Sum of Squares	Df	Mean Square	*F*-value	*P*-value	Effect size *(Partial eta squared)*
Ceramic type	7.124	1	7.124	61.880	<0.001*	0.436
Mixing percentage	0.927	4	0.232	2.013	0.100	0.091
Immersion medium	13.301	1	13.301	115.538	<0.001*	0.591
Ceramic type x Mixing percentage x Immersion medium interaction	0.013	4	0.003	0.027	0.999	0.001

*df: degrees of freedom = (n-1), *: Significant at P ≤ 0.05*

TABLE (2). The mean, standard deviation (SD) values and results of three-way ANOVA test for comparison between ΔE of immersion media with each ceramic type and different repressing wt percentages

Ceramic type	Mixing percentage	Green tea		Lemon juice		*P*-value	Effect size *(Partial eta squared)*
		Mean	SD	Mean	SD		
G.C.	100% new	3.7	0.08	2.92	0.27	<0.001*	0.142
	75% new/25% repressed	3.66	0.35	2.82	0.23	<0.001*	0.160
	50% new/50% repressed	3.58	0.36	2.76	0.3	<0.001*	0.156
	25% new/75% repressed	3.56	0.48	2.75	0.33	<0.001*	0.150
	100% repressed	3.5	0.4	2.7	0.31	<0.001*	0.148
Celtra	100% new	3.19	0.21	2.49	0.38	0.002*	0.117
	75% new/25% repressed	3.07	0.24	2.38	0.3	0.002*	0.115
	50% new/50% repressed	2.99	0.52	2.36	0.42	0.005*	0.096
	25% new/75% repressed	2.89	0.33	2.28	0.24	0.006*	0.091
	100% repressed	2.8	0.28	2.17	0.44	0.005*	0.096

**: Significant at P ≤ 0.05*

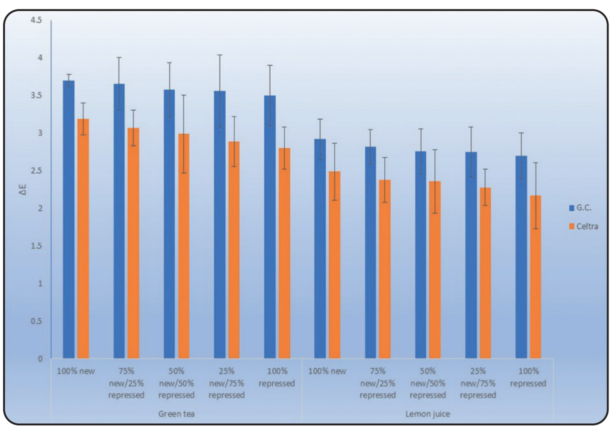

Fig. (1). Bar chart representing mean and standard deviation values for ΔE with different interactions of variables

Effect size = 0.882). Immersion medium (regardless of ceramic type, repressing weight percentage and immersion) had a statistically significant effect on mean TP (P-value <0.001, Effect size = 0.149).

The mean TP was not statistically significantly affected by the interaction between the variables (P-value = 0.248, Effect size = 0.065). The variables were not correlated with one another since their interaction was not statistically significant.

TABLE (3). Repeated measures ANOVA results for the effect of different variables on mean TP

Source of variation	Type III Sum of Squares	Df	Mean Square	*F*-value	*P*-value	Effect size *(Partial eta squared)*
Ceramic type	93.9	1	93.9	229.736	<0.001*	0.742
Mixing percentage	146.704	4	36.676	89.731	<0.001*	0.818
Immersion (Before/After)	14.928	1	14.928	600.759	<0.001*	0.882
Immersion medium	5.746	1	5.746	14.058	<0.001*	0.149
Ceramic type x Mixing percentage x Immersion x Immersion medium interaction	0.137	4	0.034	1.382	0.248	0.065

*df: degrees of freedom = (n-1), *: Significant at P ≤ 0.05*

TABLE (4). The mean, standard deviation (SD) values and results of repeated measures ANOVA test for comparison between TP of the two-immersion media with each ceramic type, repressing wt percentage before and after immersion

Ceramic type	Immersion	Mixing percentage	Green tea		Lemon juice		*P*-value	Effect size *(Partial eta squared)*
			Mean	SD	Mean	SD		
G.C.	Before immersion	100% new	11.58	0.65	11.61	0.44	0.904	0.0002
		75% new/25% repressed	11.06	0.55	11.13	0.33	0.821	0.001
		50% new/50% repressed	10.74	0.49	10.73	0.38	0.955	0.00004
		25% new/75% repressed	10.23	0.49	10.43	0.35	0.492	0.006
		100% repressed	9.87	0.3	9.85	0.5	0.943	0.0001
	After immersion	100% new	10.87	0.42	11.03	0.41	0.595	0.004
		75% new/25% repressed	10.42	0.37	10.69	0.34	0.382	0.01
		50% new/50% repressed	10.1	0.56	10.36	0.45	0.400	0.009
		25% new/75% repressed	9.65	0.3	10.22	0.47	0.067	0.041
		100% repressed	9.35	0.36	9.66	0.49	0.313	0.013
Celtra	Before immersion	100% new	13.73	0.49	13.88	0.28	0.576	0.004
		75% new/25% repressed	12.96	0.37	13.42	0.57	0.110	0.032
		50% new/50% repressed	12.04	0.3	12.09	0.25	0.854	0.0004
		25% new/75% repressed	11.27	0.46	11.31	0.5	0.871	0.0003
		100% repressed	10.4	0.55	10.42	0.38	0.938	0.0001
	After immersion	100% new	12.47	0.79	13.53	0.24	0.001*	0.131
		75% new/25% repressed	11.91	0.63	13.11	0.55	<0.001*	0.159
		50% new/50% repressed	11.09	0.53	11.82	0.29	0.021*	0.065
		25% new/75% repressed	10.43	0.71	11.12	0.56	0.026*	0.061
		100% repressed	9.72	0.46	10.23	0.39	0.049*	0.038

**: Significant at P ≤ 0.05*

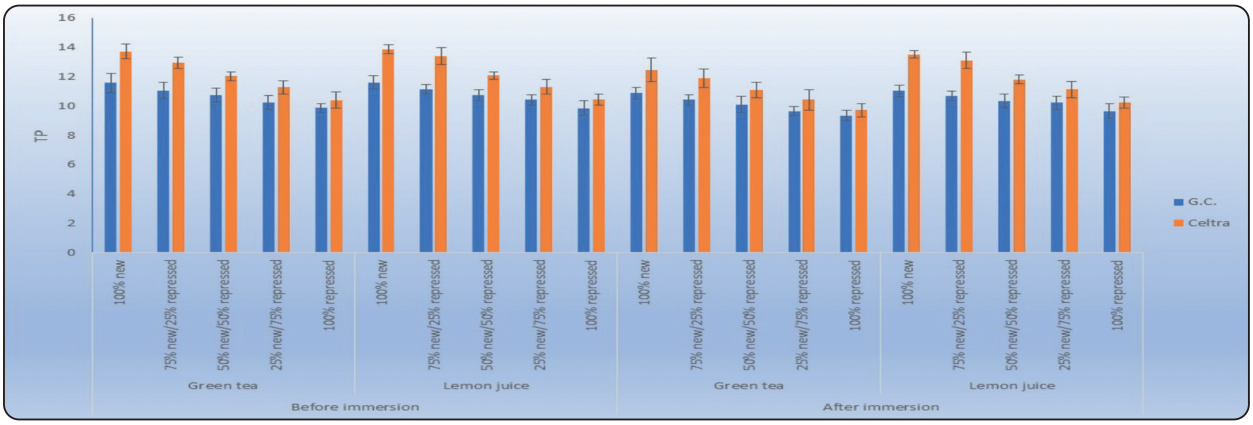

Fig. (2). Bar chart representing mean and standard deviation values for TP with different interactions of variables

DISCUSSION

As pressed zirconia reinforced lithium disilicate (Celtra press), GC Initial LiSi Press ceramics are consider expensive materials, the present study tested the effect of reusing parts that remains after heat pressing like the sprue part and the button part and repressing it with different concentrations to avoid wasting materials for economical reason.

The aim of this research was to determine the impact of repressing of Celtra Press high strength pressable glass ceramics and GC Initial® LiSi Press by assigning varying weight percentages, and the effect of immersion of ceramic discs in different types of media (Acidic and alkaline), on color, translucency using the spectrophotometer

In this study, the immersion time was12 consecutive days to simulate 1 year of beverage consumption. Specimens were submerged in the beverage solution in an incubator at 37°C to mimic oral conditions[8].

A plunger was used to press the softened ceramic ingots into the investment rings hollow using the repressing process, which involved plasticizing them at 9200 C. The pressed discs and sprues were weighed after pressing in order to determine how much ceramic was required in order to fabricate the samples. Sprues were chopped off. The repressed ceramic was ground to fit into the investment mold's opening on top. Each pressing cycle's ceramic material was added in accordance with the target Wt %, as shown in **Salem and Shalaby, 2020[2].**

The study parameters were measured as in **Salem and Shalaby, 2020** publications, with a black background, the discs' color was measured to determine their ΔE, and a spectrophotometer was used to assess their translucency against both white and black backgrounds[2].

El-Etreby 2017 stated that the findings of the SEM scans (6000x) showed that the surfaces of the two groups (pressed and repressed) were nearly devoid of pores[9]. It was primarily believed that by employing the leftover buttons and avoiding the leftover sprues, the microstructure was pore-free. Because of this, air wasn't trapped between the repressed material and the pressed group was produced with a repressed ceramic that had a practically pore-free structure, just like the manufacturer had intended[9-13].

These outcomes didn't match **Chung et al., 2009** who prepared the repressed samples using buttons and leftover sprues. Multiple tiny pores were identified by SEM scans (5000x) in the glassy matrix and at the grain boundaries of lithium disilicate crystals; these pores exhibited a greater rate of etching in comparison to the lithium disilicate phase. They suggested that the tiny pores seen by

SEM in the microstructure of the glass-ceramic reinforced with lithium disilicate might have been precipitates of Li3 PO4, which could have served as locations for the nucleation of stable lithium disilicate. The presence of several nucleation sites during crystallisation increases the risk of porosity and cracking[4].

This study results showed that the factors that had an impact on the mean color variation (ΔE) were the difference in ceramic type and immersion medium, but different repressing wt. percentage of first pressing ceramics and repressed ceramic didn't affect the mean ΔE.

These results were in coincidence with (**Gorman et al., 2000)** Moreover, it determined how many times the remaining lithium disilicate material could be compressed further and how that would affect the microstructure, crystalline phase, and biaxial flexural strength. The findings of these investigations indicated that lithium disilicate exhibits an interlocking pattern at certain locations. On the other hand, the larger lithium disilicate crystals were observed in the extra-pressed material in contrast to the pressed specimens. They claimed that this behavior was connected to a phenomenon known as "Ostwald ripening," which occurs when the solubility of tiny particles causes the microstructure to coarsen and releases surplus surface energy. It is therefore anticipated that larger grains will develop at the expense of smaller particles. This may account for the observed alteration in pigmentation among the LDS group [10].

Our research was focused on Tea and lemon juice as they are widely used beverages among the Egyptian population. In the present study, green tea medium (alkaline medium), contributed to change in mean ΔE more than the lemon juice (acidic medium), this was for both Celtra and GC ceramic type. After immersion in green tea and with all repressing percentages, GC showed a significantly higher mean ΔE than Celtra. Similarly, after immersion in lemon juice, GC demonstrated a statistically significantly greater mean ΔE than Celtra.

In line with these findings, an in-vitro study by **ElNaggar et al., 2021** confirmed that there was a significant variation in the mean of color variation between three different lithium disilicate ceramic brands with p value = 0.005, two of them were Celtra Press and GC Initial® LiSi Press, which support the significant effect of ceramic type in our findings [14].

In difference, **ElNaggar et al., 2021** noted that GC initial LiSi press had a significant lower color change than Cetral. However, in this study, G.C. showed significantly higher mean ΔE than Celtra [14].

Salem and Shalaby, 2020 were against the present study significant results. They looked into the effects of repressing Lithium disilicate ceramic on translucency and color at various weight percentages. The outcomes indicated that the combination of 75% new and 25% repressed and 50% new and 50% repressed did not differ statistically from one another. Similarly, the combination of 25% new and 75% repressed did not differ significantly from 100% repressed. These results were consistent with this study conclusion that the mixing percentage had no significant effect[2].

Regarding Color reproduction in another study by **El-Etreby 2017**, he agreed with the results of current investigation and found that significant variation was discovered between Glazed and Un-Glazed ceramics. The Pressed and Repressed groups did not differ statistically significantly. Which show the significant impact of ceramic type and the in-significant effect of repressing percentage on color change, that was comparable with the study data[9].

El-Etreby 2017 was against the present study results in translucency. He found that a statistically significant distinction was seen between glazed and unglazed ceramics, but no such distinction was detected between the pressed and repressed groups[9].

El-Etreby 2017 discussed that the unchanged translucency was due the fact that glazing plugs the pores that are exposed on the heated porcelain surface, as a consequence, diminishing its surface roughness and reducing light scattering, which maintained the translucency of the ceramic. However, in this study porosity exists, so the repressing of the ceramics reduced translucency parameter[9].

On the other hand, **El-Etreby 2017** noted that, the results of his study's examination showed that the crystalline phase and glassy matrix of IPS e.max did not alter. With the exception of a tiny increase in the size of lithium desilicated crystals, pressing heat pressed ceramics did not have a detrimental influence on the translucency parameter [9].

In the case of a colored substance layer, translucency is the capacity to permit the visibility of an underlying background. Translucency is quantified by the contrast ratio (CR) or TP. The color difference between a uniformly thick substance applied over a white or black backdrop is denoted by TP. This pertains specifically to the routine evaluation of visual translucency[15].

In terms of translucency parameter (TP), the present study results showed that all factors that were focused on, which were ceramic type, mixing wt. percentage, immersion, and immersion medium, had an influence on TP.

Eladawy et al., 2020 was in coincidence with these findings, the purpose of his study was to assess and contrast the translucency of lithium silicate glass-ceramic at varying thicknesses with that of CAD/CAM zirconia reinforced lithium disilicate ceramic. At 1.0 mm thickness, the Celtra Duo and e.max CAD ceramic materials displayed the most translucency out of all the materials he evaluated. When compared to e.max CAD, Celtra Duo ceramic materials showed more translucency across the thickness [16].

This result from **Eladawy et al., 2020** study was comparable to results of the current investigation, that recommend Celtra over GC press ceramic in terms of translucency. This was because Cetra was glazed which reduced the porosity and surface roghness. While in other unglazed types like GC, porosity increased with repressing and heating which increased the thickness and finally led to a decrease in translucency of the ceramic specimens [16].

A previous publication by **Zaghloul et al., 2013** evaluated how three pressable glass-ceramics' color stability, translucency, and surface roughness were affected by repeated pressing. He confirmed the same results of present study in relation to the impact of ceramic type, he found that Ceramic type had an impact that was statistically significant on mean values of color parameters and translucency[17].

Regarding translucency, the present findings aligned with **Zaghloul et al., 2013** were explained in his paper as that repeated pressing influenced negatively the translucency of the three pressable ceramics. Changes in the translucency of e.max ZirPress specimens may be related to devitrification of the veneering ceramics after repeated pressing which literally means to be less glasslike. So, the material gets more opaque, thus losing its vital appearance[15]. The repressed samples were prepared using buttons and discarded sprues[18, 19].

Dawood and Abo **El-Farag, 2021** was in agreement with the study findings. They assessed and compared the effect of beverage coloring on dental ceramics' ability to retain color over time. The discoloration caused by black tea (pH = 4.9) was highlighted, and this could explain the staining of the ceramic specimens after they were submerged in tea. It could also be caused by polar colorant agents adhering to the outside surface of ceramics [20].

A recent research by **Anazi and Sherif in 2023** was in agreement with the results, after the coffee immersion, every group in the experiment displayed a notable color shift from the baseline (ph 4.85 to 5.10), and the results showed that immersion medium had effect on the color change[21].

However, in **Haralur et al., 2019** study, lithium disilicate ceramics were more significantly affected by green tea comparing to Monolithic zirconia and Bilayer Zirconia types. He compared green tea, Chlorhexidine, and coffee, but we compare it with lemon juice, which may contribute to a different result between the two studies[22].

Haralur et al., 2019 concluded that Lithium disilicate ceramic was discovered to offer superior color stability with different beverages contrasted with monolithic and bilayer zirconia. Which may support the present study results that ceramic type had an effect on color[22].

CONCLUSIONS

1. In terms of ΔE, the combination of fresh ingot and repressed ceramic falls within the clinically acceptable range.
2. Ceramic type and immersion medium demonstrated a significant impact on both color variation and translucency parameter; Immersion in green tea revealed higher mean ΔE and lower mean TP than Immersion in lemon juice on both GC Initial® LiSi Press and Celtra Press high strength pressable glass ceramics.
3. Celtra is more recommended over GC press, since it had lower mean ΔE and higher mean TP after immersion in green tea and lemon juice.

RECOMMENDATIONS

1. Conducting an in-vivo trial using the same study design and aim to answer our research question.
2. Increasing the sample size and entering new ceramic types in the comparison will be recommended to get a more significant result.
3. Using more different immersion media and comparing their effect on the ceramics on long follow-up period.

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