The Egyptian Journal of Hospital Medicine (July 2023) Vol. 92, Page 6314- 6317

Influence of Repressed Lithium Silicate Ceramics on Translucency: Comparative Study

Ahmed lbrahim Eltantawy Ahmed*, Walid Abd El-Ghafar Al-Zordk, Amal Abdelsamad Sakrana
Department of Fixed Prosthodontics, Faculty of Dentistry, Mansoura University, Egypt
***Corresponding author:** Ahmed lbrahim Eltantawy Ahmed, **Mobile:** (+20) 01002327771, **Email:** dentist.eltantawy@gmail.com

ABSTRACT
Background: It is more cost-effective to press many restorations from a single ingot of lithium dislilicate glass-ceramics during the heat-pressing process. However, in many cases this is impossible and can lead to a substantial amount of waste (The sprues and button). Some dental labs reportedly recycle (repress) the remaining materials after heat pressing. **Objective:** The aim of the current study was to evaluate the effect of repressed lithium silicate ceramics on translucency (TP). **Materials and methods:** A total 60 discs were divided in 2 groups. The first group was pressed, and the second group was repressed ceramics. Each group included 30 discs (10 IPS e.max Press, 10 Celtra, 10 Ambria). The changes in translucency difference between the compared groups were evaluated. **Results:** Translucency parameter in IPS e.max Press translucency parameter in press (19.5±1.4) decreased in repress (17.3±1.4) with Δ TP (2.2±0.08), while Celtra translucency parameter in press (16.2±1.4) decreased in repress (14.2±1.4) with Δ TP (1.9±0.07), and Ambria translucency parameter in press (11.4±1.4) decreased in repress (10.11±1.4) with Δ TP (1.3±0.09). Contrast ratio of both press and repress were equal (0.7± 0.13). **Conclusions:** The translucency of repressed ceramics decreased after repress. We advise pressing glass ceramics for a single injection.
Keywords: Color change, Lithium disilicate, Repress, translucency.

INTRODUCTION

Physicians and patients paid attention to use all-ceramic systems to produce esthetic dental restorations. Because of the unique properties of these materials such as esthetics, low thermal conductivity, strength and biocompatibility. All-ceramic restorations can be made from a variety of materials and techniques today; some of these, however, call for hot pressing in a specialized furnace in order to get the desired form (pressable materials).**[(1)]**.

The dental industry has adopted hot pressing as a regular method for making all-ceramic prostheses. This method, in contrast to others like sintering, offers better crystalline dispersion within a glass matrix, reduced porosity, and the best flexibility. A pneumatic pressing furnace uses a pressurised alumina piston to press the ingots into the mould. The risers and any leftover material are discarded following the pressing and cooling processes (button). It's best to start over with a fresh ingot and press the buttons from scratch. There have been reports, however, that some dental clinics recycle these materials. The risks and benefits of this treatment are unclear due to a lack of data. It's not obvious if these buttons may be disabled and reused **[(2)]**.

Dental ceramic technology has been rapidly advancing and two of the new trends in the market are Ambria and Celtra. Ambria is a new type of hybrid ceramic that is known for its translucency and strength. It is made using a process that combines a lithium disilicate material and a zirconia material, resulting in a more natural look than traditional ceramics. Additionally, Ambria offers excellent bonding with dental substrates and can be used for a variety of procedures including veneers, inlays, onlays, and crowns **[(3)]**.

Celtra, on the other hand, is a high-performance zirconia-reinforced lithium silicate ceramic. Its strength allows for a reduction in the thickness of restorations without sacrificing esthetics, which is particularly important in anterior restorations. Celtra is also highly resistant to chipping and fractures, making it an ideal solution for patients with bruxism or grinding habits. These two new ceramic materials offer better esthetics, strength, and durability than traditional ceramics, making them valuable assets to dental practitioners **[(4)]**.

To the best authors' knowledge, no on the effect of reprocessing pressable ceramics on bond strength has been done. As a result, re-pressing (or repeated pressing) can modify the lithium silicate ceramic microstructure, and impact the ceramic ability to bond to resins. The following question arises: Does ceramic re-pressing affect color and resin bond durability? **[(5)]**. The aim of the current study was to evaluate the effect of repressed lithium silicate ceramics on translucency (TP).

MATERIALS AND METHODS

I. Materials:

The materials used in the current study are summarized in **Table 1.**

Table (1): Materials used in the current study.

Product Name	Configuration	Producer
IPS e.max Press ingot	SiO2/ Li2O/ P2O5/ K2O/ ZrO2/ other oxides and ceramic pigments	IvoclarVivadent, Germany
Celtra press ingot	SiO2/Li2O /P2O5/ ZrO2/ Al2O3/K2O/CeO2 and other oxides and pigments.	Dentsply Sirona, U.S.A
Ambria press ingot	SiO_2, Li_2O, ZrO_2, Pigment	VITAZahnfabrik, Germany

Received: 21/02/2023
Accepted: 24/04/2023

II. Methods:

The materials employed in this research were IPS e.max press (Ivoclar, vivadent), Celtra press (Dentsply, Sirona), and Ambria press (Zirconia, alumina, zirconia, zirconia) (VITAZahnfabrik). The materials were used to fabricate sixty discs were divided. First group was pressed lithium disilicate and the second group was repressed lithium disilicate. Each group includes 30 discs (10 IPS e.max Press, 10 Celtra, 10 Ambria) **(Figure 1)**.

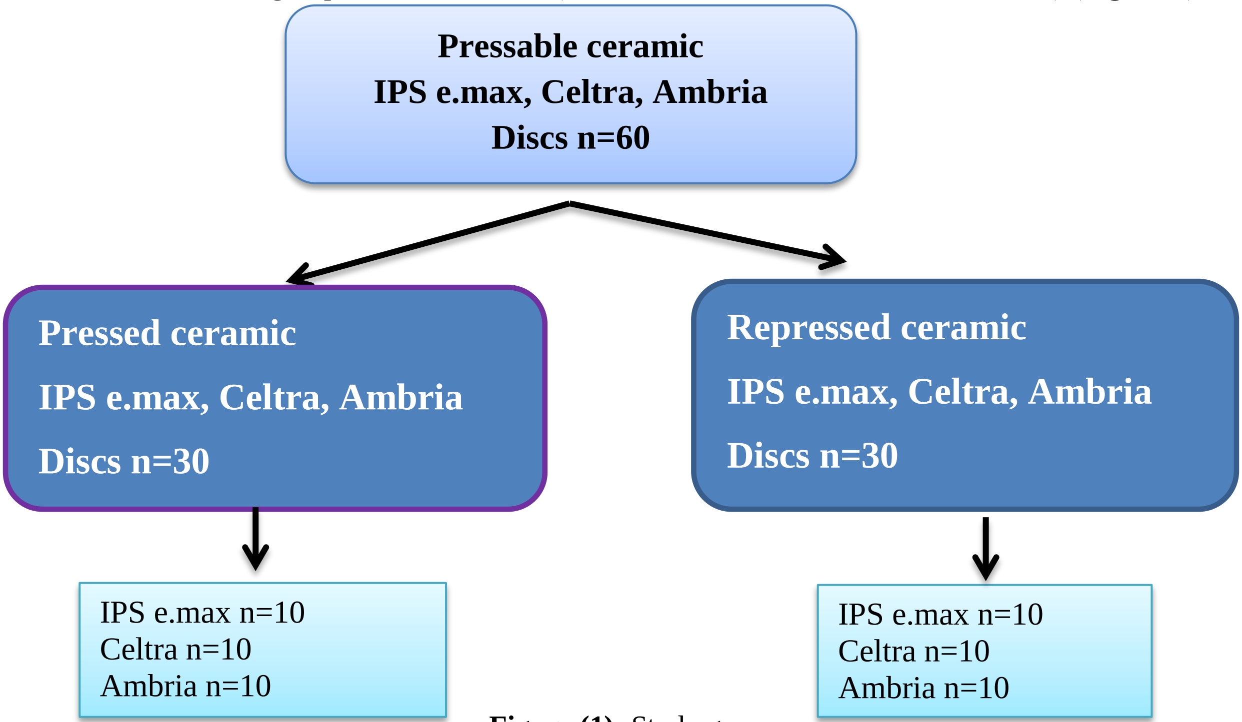

Figure (1): Study groups.

Ceramic discs Preparation:

Wax Pattern designed by exocad program and milled using CAD-CAM system Wax pattern verified using a caliper. All wax discs were sprued and invested following manufacturer instructions. A sprue of 3 mm thickness was attached to the outer diameter of the wax disc. Then the sprued discs were securely fitted to plastic base of the investment ring. Wax was eliminated by the aid of wax burn-out furnace following the manufacturer's recommendation. Investment ring was placed at the end of the furnace facing downwards for 1 hour at 850 ^{0}C. 1.5 after 1 hour the investment ring was removed from the burn-out furnace. The hot investment ring was used to install a cold IPS e.max Press ingot, followed by a cold IPS Alox plunger. After 60 minutes of cooling at room temperature, the ring was taken out of the furnace. After the investment ring had cooled, a mark was made on its underside at the same distance as the Alox plunger, and the two halves were separated using a disc. Manufacturing structure completion and polishing of ceramic discs.

TESTS:

1. Color test

1.1. Color measurements specimens:

The color parameters L*, a* & b* axes of specimens were determined as a second step under black background and white background. Three-times measurements were performed for each specimen and the mean values were obtained and recorded.

1.2 Translucency: The degree of color difference between the compared values was calculated. The translucency parameters, according to L*, H*, C* coordinates, was calculated as shown in the equation:

$$\mathbf{TP}=\sqrt{(\Delta L)2+(\Delta H)2+(\Delta C)2}$$

While ΔL was the change in value, ΔH was the change in hue, and ΔC was the change in chroma. Then change in TP (ΔTP) which is the difference between first and second sample.

Repressing of Ceramic Discs and Blocks

Each block and disk was repressed alone and separately in the same previous mannar.

Statistical analysis: The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 20 for windows. Quantitative variables were described as mean, confidence interval, standard deviation (SD), median, minimum and maximum.

RESULTS

Translucency parameter of the repress groups decreased than press groups. IPS e.max Press translucency parameter in press group (19.5±1.4) decreased in repress group (17.3±1.4) with Δ TP (2.2±0.08), while Celtra translucency parameter in press group (16.2±1.4) decreased in repress group (14.2±1.4) with Δ TP (1.9±0.07) and Ambria translucency parameter in press group (11.4±1.4) decreased in repress group (10.11±1.4) with Δ TP (1.3±0.09) (**Table 2**).

Table (2): Translucency (TP) of different Material (IPS e.max Press, Celtra and Ambria) and Δ TP for press and repress of lithium disilicate glass ceramic.

Variable	Mean	Confidence interval		Standard deviation	Median	Minimum	Maximum
		Lower	Upper				
		TP					
Press							
IPS e.max Press	19.5	18.5	20.5	1.4	19.5	17.4	21.5
Celtra	16.2	15.2	17.2	1.4	16.1	14.1	18.2
Ambria	11.4	10.4	12.3	1.4	11.4	9.3	13.4
Repress							
IPS e.max Press	17.3	16.3	18.3	1.4	17.3	15.2	19.3
Celtra	14.2	13.2	15.2	1.4	14.2	12.2	16.3
Ambria	10.11	9.1	11.1	1.4	10.1	8.1	12.2
Δ TP							
IPS e.max Press	2.2	2.2	2.3	0.08	2.2	2.1	2.4
Celtra	1.9	1.9	1.9	0.07	1.9	1.9	2.02
Ambria	1.3	1.2	1.3	0.09	1.3	1.1	1.4

DISCUSSION

Repressing lithium disilicate ceramic, according to the null hypnosis, does not alter its hue or transparency. The hypnosis with no effect is dismissed. At repression, this investigation found a statistically significant variation in the translucency parameter among all materials.

In this study regarding translucency parameter there is significant difference (P<0.001) between every two types of materials. Regarding contrast ratio, there is significant difference (P<0.001) between Ambria and IPS e.max Press and between Ambria and Celtra in press steps. Repress has significant effect on translucency. Within the same type of material there is significant difference (P<0.0m01) between translucency during press (15.7±3.6) and repress (13.8±3.26) (Δ TP 1.8±0.4), while repress has no significant effect on contrast ratio. Within the same type of material there is no significant difference between contrast ratio during press and repress.

This study showed that translucency parameter in repressed material decreased than pressed on. Therefore, he agreed with **Nejatidanesh *et al.* [6]**, who revealed the effect of repress of lithium disilicate on total porosity volume, color and translucency and concluded that with increasing number of repress cycles, porosity volume decreased, porosity increased and color change and translucency increased. These color and light transmission changes can be related to porosity volume**.**

Albakry and colleagues [7] with also **El-Etreby and Ghanem** [8] reported Crystals of lithium disilicate grew noticeably under pressure; however the effect was just a slight opacity. Both lithium disilicate and zirconia reinforced lithium disilicate exhibited a substantial change after repress, confirming previous reports that repress might make a major difference for ceramic systems.

Crystal phases as a percentage of the glassy matrix, crystal length and width (size), viscosity of the remaining glass phase during repress, and decreased pore size and quantity are all examples of how repressing can alter a material's microstructure. The crystals redistributed and have grown due to high temperature and pressure [9]**.**

Changes in the translucency of specimens may be related to devitrification of the ceramics after repeated pressing which literally means to be less glasslike. So, the material gets more opaque, thus losing its vital appearance [10].

This agrees with **Yılmaz and colleagues** [11] where the lithium disilicate material's thick crystalline structure is negatively affected by and damaged by exposure to high temperatures during repression. Surface accumulation followed a pyroclastic flow caused by several high-temperature firings. Translucency decreases and refractive index changes as a result of contour loss, recrystallization, and devitrification.. Repressed ceramic decreased the light transmittance and contrast ratio compared to pressed material. Furthermore, the results show the mean value, chromium and hue against the black background showed a significant difference comparing between press and repressed ceramic, regarding the change in translucency parameter at different materials.

LIMITATIONS

1. Because this was an in vitro investigation, we cannot draw any conclusions about how abutment shade or cement shade influenced the ultimate

restoration color after repressing and numerous firings.
2. One ceramic material's shade variances are measured using a spectrophotometer. The sample size was not determined by a power analysis. Additionally, the disc-shaped specimens were not crown-shaped.
3. More research is needed to account for a wider range of resin cement kinds, thicknesses, and colors, as well as ceramic thicknesses and shades from different manufacturers.

CONCLUSIONS

The translucency of repressed lithium disilicate (IPS e.max Press, Celtra and Ambria) decreased after repress. Pressing of glass ceramic materials for one injection is highly recommended.

RECOMMENDATIONS

1. The results of this study may be helpful to dental technologist to avoid the use of left-over buttons of press in restorations in esthetic area because of the significant decrease in translucency.
2. Examining the impact of fire and ageing on the color and translucency of third-press material requires more research.
3. There needs to be further research done on the viability of third press group as a core material, as well as an analysis of how repressing and ageing affect its color and translucency after veneering.

- **Supporting and sponsoring financially:** Nil.
- **Competing interests:** Nil.

REFERENCES

1. **Kim M, Ahn J, Kim J *et al.* (2013):** Effects of the sintering conditions of dental zirconia ceramics on the grain size and translucency. J Adv Prosthodont., 5:161–6.
2. **Alkadi L, Ruse N (2016):** Fracture toughness of two lithium disilicate dental glass ceramics. J Prosthet Dent., 116(4):591-6.
3. **Nogueira A, Della Bona A (2013):** The effect of a coupling medium on colour and translucency of CAD–CAM ceramics. J Dent., 41:18-23.
4. **Garboza C, Berger S, Guiraldo R *et al.* (2016):** Influence of Surface Treatments and Adhesive Systems on Lithium Disilicate Microshear Bond Strength. Braz Dent J., 27(4):458-62.
5. **Khashayar G, Bain P, Salari S *et al.* (2014):** Perceptibility and acceptability thresholds for colour differences in dentistry. J Dent., 42:637-44.
6. **Nejatidanesh F, Azadbakht K, Savabi O *et al.* (2020):** Effect of repeated firing on the translucency of CAD-CAM monolithic glass-ceramics. J Prosthet Dent., 28:62-73.
7. **Albakry M, Guazzato M, Swain M (2004):** Biaxial flexural strength and microstructure changes of two recycled pressable glass ceramics. J Prosthodont., 13:141-9.
8. **El-Etreby A, Ghanem L (2017):** The effect of repeated heat-pressing on the biaxial flexural strength and surface roughness of lithium disilicate glass ceramics. EDJ., 63:53-60. Doi.10.21608/EDJ.2017.75033
9. **Tang X, Tang C, Su H *et al.* (2014):** The effects of repeated heat pressing on the mechanical properties and microstructure of IPS e.max Press. J Mech Beha Biomed Mater., 40:390-6.
10. **Yuan K, Wang F, Gao J *et al.* (2013):** Effect of sintering time on the microstructure, flexural strength and translucency of lithium disilicate glass– ceramics. J Non-Cryst Solids, 362:7-13.
11. **Yılmaz K, Gonuldas F, Ozturk C (2014):** The effect of repeated firings on the color change of dental ceramics using different glazing methods. J Adv Prosthodont., 6(6):427-33.