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Translucency Of Veneers Made From Different Lithium Disilicate CAD/CAM Materials With Different Thicknesses.

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Abstract:
Background: *Dental ceramics are designed and distributed with varying translucency in order to mimic the natural tooth. As with any translucent material, as its thickness increases, so does its opacity. This leads to an added level of difficulty in determining the correct shade especially with a cosmetic modality such as laminate veneers. Owing to their preparation design a single veneer varies in thickness, gradually increasing from the margin to the incisal edge. A prudent clinician must accommodate this factor into their treatment during shade determination if they are to achieve an acceptable aesthetic result. There exists a definite relation between restoration thickness and its optical properties. This further complicates the issue of selecting the proper ceramic for shade matching with natural tooth especially in minimally invasive interventions. Therefore, the present study aims to investigate the effect of increasing the thickness on the optical properties of zirconia-reinforced lithium silicate in comparison to lithium disilicate.*
Materials and Methods*: An in-vitro study comparing LT Translucency of Three Types of Machinable Lithium Disilicate Ceramic Blocks were used in the present study.*
Results*: There was a significant difference between different groups ($p<0.001$). The highest value was found in Rosetta (32.91 ± 2.26), followed by Emax (31.41 ± 2.47), while the lowest value was found in Upcera (31.15 ± 2.47). Post hoc pairwise comparisons showed Rosetta to have a significantly higher value than other groups ($p<0.001$).*
Key Word*: CAD/CAM; Lithium Disilicate; CAD Blocks; Translucency; Thickness; Ivoclar; HAAS; Upcera.*

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I. Introduction

Conservatism lies deep in the heart of modern restorative dentistry. Achieving a functional and aesthetically pleasing result while maintaining as much natural tooth structure as possible is a desirable prospect for both patient and practitioner(1). Cosmetic approaches such as anterior laminate veneer restorations enjoy a solid reputation of predictability and clinical success (2) (3)however that was not always the case. Laminate veneers have evolved in terms of material, fabrication, and method of fixation. From humble hollowed out resin teeth cemented with denture adhesive to computer-controlled milling of ceramics and adhesive bonding to tooth structure. It is then reasonable to understand why practitioners were late to adopt laminate veneers due to their questionable longevity. The advent of bonding ceramics to tooth structure led to the revival of this treatment in modern dental practice,(4) although the feldspathic porcelain's inherent weakness remained. The emergence of high strength glass based ceramics such as lithium disilicate boast greater strength and the ability to bond to current adhesive systems,(5) however it has yet to dethrone conventional feldspathic porcelain as the most aesthetic choice for bonded anterior restorations.(6),(7) This could be attributed to the manufacturing process in which the freedom of internal characterization and optimal translucency that mimics natural enamel are, to this day, what ceramic technology has not been able to imbibe in this new generation of high strength glass ceramics. Pressable ceramics and machined ceramics produce the bulk of the restoration and hence they are often criticized as lacking depth.

II. Material And Methods

An in-vitro study comparing LT Translucency of Three Types of Machinable Lithium Disilicate Ceramic Blocks were used in the present study.

Materials:

Table (1): Materials

No.	Scientific Name	Tradename	Manufacturer	Shade	Translucency	Composition	Batch No.
1	Lithium Disilicate Glass Ceramic	IPS e.max CAD	Ivoclar Vivadent AG, Liechtenstein	A3	Low Translucency	SiO_2:57-80% Li_2O:11-19% K_2O: 0-13% P_2O_5: 0-11% ZnO: 0-8% ZrO_2: 0-8% Pigments & Other Oxides: 0-12%.	125664
2	Lithium Disilicate Glass Ceramic	Up.CAD	Shenzhen Upcera Dental Technology Co., Ltd. Guangdong, China	A3	Low Translucency	SiO_2: 58.5-72.5% Li_2O: 13-15% K_2O: 3-5% Other Oxides: 7.5-25%	65489
3	Lithium Disilicate Glass Ceramic	Rosetta SM CAD	HASS Bio Corp, Gangwon-do, Korea	A3	Low Translucency	CAS no. 66402-68-4: 100%	56845

Table (2): Mechanical &Physical Properties:

	IPS e.max CAD	**Up.CAD**	**Rosetta SM**
Flexural Strength (mPa)	**≥360**	**400**	**>300**
Chemical Solubility (μg/cm2)	**< 100**	**＜100**	**<100**
Coefficient of Thermal Expansion (CTE)	**10.1 ± 0.5**	**(8.5-11）x10-6K-1**	**10.0 (±0.5) x 10-6 K-1**

Study Duration: June 2022 to June 2023.
Sample size: 60 Samples.
Sample size calculation: The discs were divided according to the ceramic types into 3 groups:
Group I: Ivoclar emax CAD
Group U: Upcera CAD Blocks
Group R: Rosetta SM CAD Blocks.
Each group was equally subdivided according to the thickness into Two sub-groups:
Subgroup A: 0.3 mm
Subgroup B: 0.7 mm

Table (3): Factorial experimental design of the present study

Material / Thickness	**Ivoclar e.max CAD (I)**	**Rosetta SM CAD Blocks (R)**	**Up.CaD Blocks (U)**	**Total**
0.3 mm (A)	**AI** (n=10)	**AR** (n=10)	**AU** (n=10)	30
0.7 mm (B)	**BI** (n=10)	**BR** (n=10)	**BU** (n=10)	30
Total	20	20	20	60

Methodology
Power Analysis:

A power analysis was designed to have adequate power to apply a statistical test of the null hypothesis that there is no difference would be found between different tested groups regarding translucency. By adopting an alpha (α) level of (0.05), a beta (β) of (0.2) (i.e. power=80%), and an effect size (f) of (0.551) calculated based on the results of a previous study[1]; the sample size (n) was found to be a total of (48) samples (i.e. 16 samples per group and 8 samples per subgroup). Sample size calculation was performed using G*Power version 3.1.9.7[2].

Categorical data will be represented as frequency (n) and percentage (%) and will be analyzed using chi square test. Numerical data will be explored for normality by checking the data distribution, calculating the mean and median values and using Shapiro-Wilk test. If the data was found to be normally distributed, it will be presented as mean and standard deviation values and two-way ANOVA followed by Tukey's post hoc test will be used for the analysis. If the assumption of normality was found to be violated; the data will be presented as median and range values and will be analyzed using Kruskal-Wallis test followed by Dunn's post hoc test with Bonferroni correction. The significance level will be set at $p \leq 0.05$ for all tests. Statistical analysis will be performed with IBM® SPSS® Statistics Version 26 for Windows**.**

Sample Preparation:

The blocks of IPS e.max CAD, Upcera CAD Blocks and Rosetta SM CAD Blocks of Dimensions 18x15x15 of LT Translucency and Shade A3 were sectioned in a transverse orientation with diamond coated discs in a precision saw machine (Buehler Isomet 4000). The ceramic blocks were fastened on to the sample mount and the cutting thickness was adjusted followed by steady cut by the precision saw to obtain specimens of approximately 0.3, 0.7 mm thicknesses (±0.05 mm).

The thickness of each specimen group was checked using a digital calliper**.**

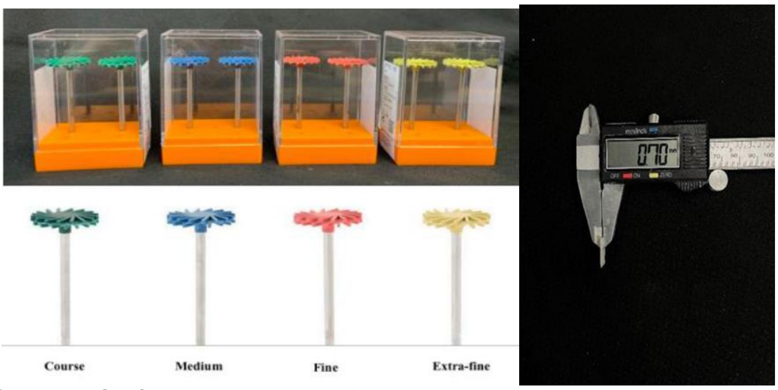
All the specimens were then crystalized in a dental ceramic Furnace following the manufacturers' instructions for each material programmed for IPS e.max CAD, Upcera CAD Blocks and Rosetta SM CAD Blocks specimens respectively.

Finishing & Glazing of ceramic discs:

Finishing of the ceramic discs was performed using a clinical dental handpiece with twist polishers (LUS05 Luster extra-oral twist porcelain polishing kit, Meisinger USA LLC), ranging from the green coarse, medium blue, fine pink and finally the extra-fine yellow. It is used for finishing, eliminating scratches, and smoothening surfaces as recommended by the manufacturer. Thickness was measured after the dry polishing was conducted. A small amount of glaze paste and glaze liquid were mixed thoroughly on a plastic slab, until it reaches a creamy and stringy consistency. Then, the mix was applied on the specimen's surface with a brush to produce a uniform thickness, moving from the centre toward the outer surface of the specimen until one layer of complete coating is achieved, avoiding any thick area with IPS e.max Ceram Glaze paste and liquid (Ivoclar Vivadent, Schaan, Liechtenstein)

Glazing technique firing protocol was performed using a Programat EP 3010 Furnace which used for firing cycles and parameter set according to manufacturer's recommendations for each material. The specimens were allowed to cool at room temperature after the completion of the firing cycle.

Finally, the thicknesses of the specimens were checked using a digital calliper.



(LUS05 Luster extra-oral twist porcelain kit, Meisinger USA LLC)

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[1]Harada, Kosuke, et al. "A comparative evaluation of the translucency of zirconia's and lithium disilicate for monolithic restorations." *The Journal of prosthetic dentistry* 116.2 (2016): 257-263.

[2]Faul, Franz, et al. "G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences." *Behavior research methods* 39.2 (2007): 175-191.

® IBM Corporation, NY, USA.

®SPSS, Inc., an IBM Company.

Digital calliper.

Translucency:
All specimens were measured for translucency using a Vita Easyshade spectrophotometer Advance 4.0.

Vita Easyshade spectrophotometer Advance 4.00

The spectrophotometer was calibrated in the calibration slot according to manufacturer's instructions to ensure accuracy of every measurement. The Vita Easyshade spectrophotometer aperture was centralized on the center of each disc and given the order to measure its CIELAB (Commission Internationale de l'Eclairage) coordinates (L*, a*, and b*) under neutral grey background for all subgroups A E C (n=60). Three measurements for each coordinate were taken for each specimen and their average was recorded. For measuring translucency, the translucency parameter (TP) of three subgroups (n=60) was detected using the Vita Easyshade spectrophotometer Advance 4.0 through diffuse reflectance method. The TP was detected by calculating the color difference for each specimen of both thicknesses of 0.7mm and o.3mm when it was placed over a white background or reference (100 lightness) and then over a black background or reference (0 lightness) .

Hydrothermal aging:
The samples were stored in distilled water at 37 ºC for 24 hours prior to thermal cycling according to the ISO (International Organization for Standardization) recommendations. The specimens were submitted to 5000 thermocycles in a thermal cycling simulation machine *****between 5°C and 55°C in water to estimate 6 months of oral conditions. Dwell time (Immersion time in each bath) is 30 seconds. Transfer time between baths is 5 seconds.

Measurements After hydrothermal aging:
All specimens (n=60) were measured for color stability and translucency after hydrothermal aging using a Vita Easyshade spectrophotometer advance 4.0 and recorded similarly as before. Mean TP values were calculated from results taken before and after aging according to the following equation: TP= ([L*1 – L*2] 2 + [a*1 – a*2] 2 + [b*1 – b*2] 2)1/2. Where L*1 is lightness before aging, L*2 is lightness after aging, a*1 is a value before aging, a*2 is a value after aging, b*1 is b value before aging, b*2 is b value after aging.

III. Results

1- Effect of different variables and their interaction:
Effect of different variables and their interaction on translucency parameter (TP) were presented in table (7).
There was a significant interaction between the three tested variables (p=0.047).

Table (4): Effect of different variables and their interactions on translucency parameter (TP)

Source	Sum of Squares	df	Mean Square	f-value	p-value
Material	72.43	2	36.21	13.57	**<0.001***
Thickness	429.67	1	429.67	161.09	**<0.001***
Aging	84.86	1	84.86	596.23	**<0.001***
Material * Thickness	5.021	2	2.510	0.941	**0.396ns**
Material* Aging	0.62	2	0.31	2.17	**0.124ns**
Thickness*aging	0.11	1	0.11	0.81	**0.373ns**
Material * thickness*aging	0.92	2	0.46	3.24	**0.047***

df =degree of freedom*; significant ($p \leq 0.05$) ns; non-significant (p>0.05)

2- Effect of Material:

Mean, Standard deviation (SD) values of translucency parameter (TP) for different materials were presented in table (8) and figure (17)

There was a significant difference between different groups ($p<0.001$). The highest value was found in Rosetta (32.91±2.26), followed by Emax (31.41±2.47), while the lowest value was found in Upcera (31.15±2.47). Post hoc pairwise comparisons showed Rosetta to have a significantly higher value than other groups ($p<0.001$).

Table (5): Mean, Standard deviation (SD) values of translucency parameter (TP) for different materials

Translucency parameter (TP) (mean±SD)			p-value
Emax	**Rosetta**	**Upcera**	
31.41 ± 2.47^{B}	32.91 ± 2.26^{A}	31.15 ± 2.47^{B}	**<0.001***

Different superscript letters indicate a statistically significant difference within the same horizontal row *; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)

3- Effect of thickness:

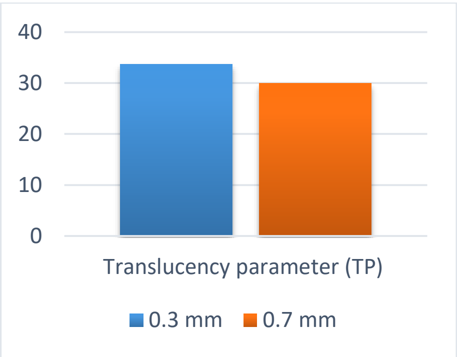
Mean, Standard deviation (SD) values of translucency parameter (TP) for different thicknesses were presented in table (9) and figure (18).

0.3 mm thick samples (33.72±1.71) had a significantly higher value than 0.7 mm thick samples (29.93±1.56) ($p<0.001$).

Table (6): Mean, Standard deviation (SD) values of translucency parameter (TP) for different thicknesses

Translucency parameter (TP) (mean±SD)		p-value
0.3 mm	**0.7 mm**	
33.72±1.71	29.93±1.56	**<0.001***

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)



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4- Effect of aging:

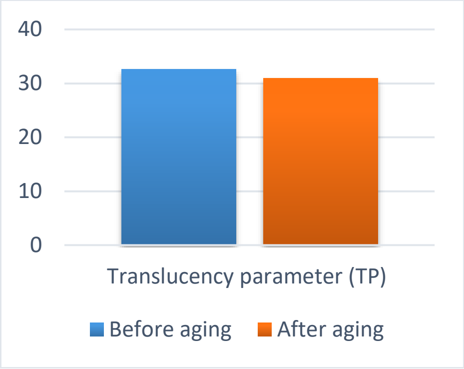
Mean, Standard deviation (SD) values of translucency parameter (TP) before and after aging were presented in table (10) and figure (19)

Value measured before aging (32.67±2.26) was significantly higher than value measured after aging (30.98±2.47) ($p<0.001$).

Table (7): Mean, Standard deviation (SD) values of translucency parameter (TP) before and after aging

Translucency parameter (TP) (mean±SD)		p-value
Before aging	**After aging**	
32.67±2.26	30.98±2.47	**<0.001***

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)



5- Effect of material within other variables:
Mean, Standard deviation (SD) values of translucency parameter (TP) for different materials within other variables were presented in table (11) and figure (20)

1- 0.3 mm:

- **Before aging:**

There was no significant difference between different groups (p=0.053). The highest value was found in Rosetta (35.39±1.76), followed by Emax (34.30±0.65), while the lowest value was found in Upcera (33.89±1.40).

- **After aging:**

There was no significant difference between different groups (p=0.082). The highest value was found in Rosetta (33.73±1.93), followed by Emax (32.81±0.86), while the lowest value was found in Upcera (32.18±1.47).

2- 0.7 mm:

- **Before aging:**

There was a significant difference between different groups (p<0.001). The highest value was found in Rosetta (31.92±0.52), followed by Emax (30.25±0.46), while the lowest value was found in Upcera (30.24±1.03). Post hoc pairwise comparisons showed Rosetta to have a significantly higher value than other groups (p<0.001).

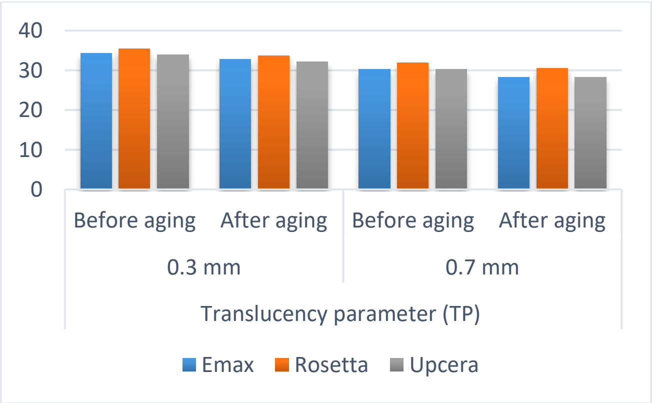
- **After aging:**

There was a significant difference between different groups (p<0.001). The highest value was found in Rosetta (30.61±0.64), followed by Upcera (28.30±1.31), while the lowest value was found in Emax (28.27±1.03). Post hoc pairwise comparisons showed Rosetta to have a significantly higher value than other groups (p<0.001).

Table (8): Mean, Standard deviation (SD) values of translucency parameter (TP) for different materials within other variables.

Thickness	Aging	Translucency parameter (TP) (mean±SD)			p-value
		Emax	Rosetta	Upcera	
0.3 mm	Before aging	34.30±0.65[A]	35.39±1.76[A]	33.89±1.40[A]	**0.053ns**
	After aging	32.81±0.86[A]	33.73±1.93[A]	32.18±1.47[A]	**0.082ns**
0.7 mm	Before aging	30.25±0.46[B]	31.92±0.52[A]	30.24±1.03[B]	**<0.001***
	After aging	28.27±1.03[B]	30.61±0.64[A]	28.30±1.31[B]	**<0.001***

Different superscript letters indicate a statistically significant difference within the same horizontal row *; significant ($p \leq 0.05$) ns; non-significant (p>0.05)



6- Effect of thicknesses within other variables:
Mean, Standard deviation (SD) values of translucency parameter (TP) for different thicknesses within other variables were presented in table (12) and figure (21)

1- Emax:

- **Before aging:**

0.3 mm thick samples (34.30±0.65) had a significantly higher value than 0.7 mm thick samples (30.25±0.46) ($p<0.001$).

- **After aging:**

0.3 mm thick samples (32.81±0.86) had a significantly higher value than 0.7 mm thick samples (28.27±1.03) ($p<0.001$).

2- Rosetta:

- **Before aging:**

0.3 mm thick samples (35.39±1.76) had a significantly higher value than 0.7 mm thick samples (31.92±0.52) ($p<0.001$).

- **After aging:**

0.3 mm thick samples (33.73±1.93) had a significantly higher value than 0.7 mm thick samples (30.61±0.64) ($p<0.001$).

3- Upcera:

- **Before aging:**

0.3 mm thick samples (33.89±1.40) had a significantly higher value than 0.7 mm thick samples (30.24±1.03) ($p<0.001$).

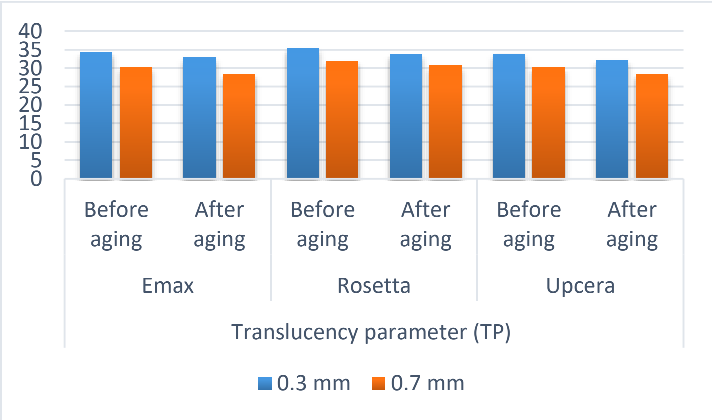
- **After aging:**

0.3 mm thick samples (32.18±1.47) had a significantly higher value than 0.7 mm thick samples (28.30±1.31) ($p<0.001$).

Table (9): Mean, Standard deviation (SD) values of translucency parameter (TP) for different thicknesses within other variables

Material	Aging	Translucency parameter (TP) (mean±SD)		p-value
		0.3 mm	0.7 mm	
Emax	Before aging	34.30±0.65	30.25±0.46	<0.001*
	After aging	32.81±0.86	28.27±1.03	<0.001*
Rosetta	Before aging	35.39±1.76	31.92±0.52	<0.001*
	After aging	33.73±1.93	30.61±0.64	<0.001*
Upcera	Before aging	33.89±1.40	30.24±1.03	<0.001*
	After aging	32.18±1.47	28.30±1.31	<0.001*

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)



7- Effect of aging within other variables:

Mean, Standard deviation (SD) values of translucency parameter (TP) before and after aging within other variables were presented in table (13) and figure (22)

1- Emax:

- **0.3 mm:**

Value measured before aging (34.30±0.65) was significantly higher than value measured after aging (32.81±0.86) ($p<0.001$).

- **0.7 mm:**

Value measured before aging (30.25±0.46) was significantly higher than value measured after aging (28.27±1.03) ($p<0.001$).

2- Rosetta:

- **0.3 mm:**

Value measured before aging (35.39±1.76) was significantly higher than value measured after aging (33.73±1.93) ($p<0.001$).

- **0.7 mm:**

Value measured before aging (31.92±0.52) was significantly higher than value measured after aging (30.61±0.64) ($p<0.001$).

3- Upcera:

- **0.3 mm:**

Value measured before aging (33.89±1.40) was significantly higher than value measured after aging (32.18±1.47) ($p<0.001$).

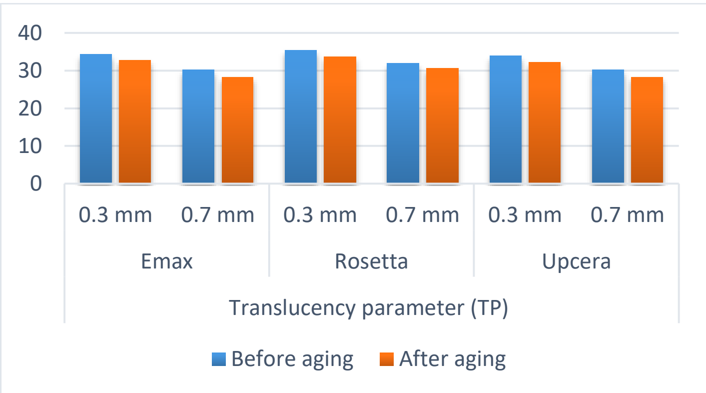
- **0.7 mm:**

Value measured before aging (30.24±1.03) was significantly higher than value measured after aging (28.30±1.31) ($p<0.001$).

Table (10): Mean, Standard deviation (SD) values of translucency parameter (TP) before and after aging within other variables

Material	Thickness	Translucency parameter (TP) (mean±SD)		p-value
		Before aging	After aging	
Emax	0.3 mm	34.30±0.65	32.81±0.86	**<0.001***
	0.7 mm	30.25±0.46	28.27±1.03	**<0.001***
Rosetta	0.3 mm	35.39±1.76	33.73±1.93	**<0.001***
	0.7 mm	31.92±0.52	30.61±0.64	**<0.001***
Upcera	0.3 mm	33.89±1.40	32.18±1.47	**<0.001***
	0.7 mm	30.24±1.03	28.30±1.31	**<0.001***

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)



IV. Discussion

Lithium disilicate ceramic material which has durability and superior aesthetics is considered one of the most important ceramic material available nowadays. The light diffusion and translucency of IPS E-max ceramics were reached to replicate natural tooth appearance and structure.[8]

The desire for enhanced aesthetics has resulted in increased acceptance and extensive use of ceramic fixed restorations.[9]

In this study CAD/CAM lithium disilicate ceramic blocks were used, as their standardized manufacturing process results in blocks with more homogenous structure, reliable quality, and better mechanical and physical properties. For many years, CAD/CAM LS2 ceramic blocks were exclusively produced by only one manufacturer (Ivoclar Vivadent, Schaan, Liechtenstein). But there are other brands emerged in the market as Rosetta SM by Hass, Gangneung, Korea and Up.CAD by Upcera, Schenzen, China.The objective of this study is to investigate the effect of the three machinable materials with different thicknesses on the translucency potential, using Vita EasyShade Spectrophotometer.

The development of dental ceramic techniques offered a veneer thickness of about 0.3–0.7 mm, decreasing tooth reduction amount and ensuring it to be within the enamel structure and effective bonding.[10]

Different thicknesses were studied to test the relationship between translucency and thickness as it was said that the relationship between contrast ratio and the thickness is linear.[11]

Machinable CAD blocks were cut using a low-speed diamond saw (Buehler-Isomet LakeBulff, IL, USA) to reach two uniform standard thicknesses of (0.3mm) and (0.7mm) which were selected in our study.

Square-shaped specimens were fabricated instead of veneers, to guarantee that the light is reflected at the same level and distance from the specimen surface to the lens of the spectrophotometer, and to eliminate any other factors which may affect translucency as surface curvature, cement shade or natural tooth discoloration.[12]

Finishing and polishing were done in order to simulate real clinical conditions meanwhile it was kept to minimal so as not to adversely affect the microstructure of our specimens. A standardized sequential minimal finishing and polishing protocol was followed for standardization among all specimens as adopted by other authors, and manufacturer instructions.[13]

Spectrophotometry is a method used to quantitatively measure color and translucency in dentistry.[14]

The use of the Vita Easyshade spectrophotometer for obtaining the CIELAB coordinates is commonly used in the field of dental research [15], accordingly it was used in our study to obtain the ΔE and TP for the specimens. Spectrophotometers offered a 33% increase in accuracy and a more objective match in 93.3% of cases compared with observations by the human eye, or conventional techniques. Spectrophotometers have a longer working life than colorimeters and are unaffected by object metamerism.[16]

Vita Easyshade spectrophotometer was used to measure all samples as recommended by previous studies[17] [18] [19] it is simple, easy and accurate. Dozić et al [20] reported that Vita Easyshade was the most reliable commercially available device for shade matching in both in vivo and in vitro situations.

For this study 5,000 cycles were elected to represent 6 months of oral environment. A study conducted by Acar et al[21] in which the color difference and translucency after thermocycling was evaluated after 5,000 cycles corresponding to 6 months of clinical services.

The null hypothesis that translucency was not influenced by the type or thickness of ceramics was rejected.

Translucency of the tested materials in the current study has significantly decreased for all ceramic materials with each incremental increase in specimen's thickness, that goes in accordance with other studies, who reported the significant decrease in the translucency parameter of ceramics materials with increasing specimens the thicknesses.[22]

Translucency varied with thickness of the same ceramic material and shade. As expected, thinner samples exhibited greater TP and RTP values. This may be attributed to the thicknes were light travel to either be reflected or refracted. This aspect is of paramount importance, because, translated to a clinical situation, even a small change in thickness may interfere with the final visual outcome of a restoration. These findings are in agreement with a previous study that analysed the translucency of glass and zirconia ceramics of different thicknesses (0.6 to 2 mm for glass ceramics and 0.4 to 1.0 mm for zirconia ceramics). That study concluded that the translucency of dental ceramics increased with decreasing thickness, the amount of change being material dependent. The use of both TP and RTP in the characterization of material's translucency was supported by the uniformity of thickness values between the different ceramic materials studied, as thickness highly affects translucency. [14]

Antonson and Anusavice (2001) investigated that translucency of dental ceramics is a function of ceramic thickness. They found a positive linear correlation between contrast ratio and thickness.[23]

Wang et al. (2013) who reported that the translucency of dental ceramics was greatly affected by two important factors which are the material type and its thickness. the translucency of all materials increased exponentially as the thickness decreased[24]. Which also in agreement with Shamseddine et al. (2017) who reported that as we increase the thickness between 0.6 and 0.8 mm and between 0.6 and 1 mm there is a difference in the TP[25]

Heffernan et al.[26] concluded that the range of translucency in ceramics at clinically relevant thicknesses resulted from different crystalline composition.

All these previous studies came in agreement with our study which confirmed a significant increase in translucency was also found as a result of the decrease in thickness.

The lowered translucency parameter with increasing specimens' thickness could be attributed to the lowered translucency values for all ceramic specimens, causing increased masking ability with 1.5-mm-thick discs. These results are in agreement with those reported by Vichi et al., where translucency values decreased with increasing ceramic thickness from 1.0 to 1.5 mm. The results of the current study match the outcome of Hilgert study, who also reported the lowered translucency values with increasing ceramic veneers thickness from 0.4 to 0.7 and 1.0 mm.(27) (28)

The glass ceramics had a range of 2.2 to 25.3 TP values at various thicknesses. The TP value of human dentin with a thickness of 1.0 mm has been determined to be 16.4 and that of human enamel 18.1(29)

These results also confirmed the ability of glass ceramics to provide a better optical match to natural teeth(30).

The results from this study showed that the colour coordinates of the samples before and after thermocycling differed from each other and that thermocycling had a significant impact on translucency, these materials were chosen because of their frequent use among practitioners. Colour measurements of the samples with spectrophotometer showed that all tested materials had different colour coordinates even though they were all chosen A3 LT and this means that the colour coordinates are more related to the material. These results were also found in literature(31) Of the machinable CAD blocks the one that had the highest translucency was the Rosetta SM before and after aging, this could be as a result of the slight difference in composition.

The artificial aging by thermal cycling reduced the TP values significantly for all samples. The effect of thermal cycling on the optical properties (color and opacity) could be explained with the increase of the crystal size, the orientation of the crystals, and perhaps with the change of the glass matrix.(32) (33)

It was found in our study regarding translucency parameter (TP) that Rosetta SM Cad Blocks showed higher mean of translucency than IPS e.max CAD & Upcera CAD Blocks. H. Zhang et. Al concluded that the amount of MgO in lithium disilicate structure affects physical and optical properties of the glass structure, the glass-ceramic with MgO content 0.56 mol% after heat treatment at 840◦C exhibits best comprehensive performance with the flexural strength being 312 ± 23 MPa, and the average visible light transmittance being 37.3% under the thickness of 1.62 mm. In addition, the glass-ceramic with MgO content 0.56 mol% exhibits higher hardness and thermal expansion stability than those of the market circulation products, indicating that the glass-ceramic has great market application prospects.(34)

In his study about preparation of lithium disilicate materials Y. Bai concluded that Two stage program gives better translucency in the final product than one stage program for crystallization of the material as the two stage heat treatment can achieve finer microstructure but it is more sensitive to the annealing time.(35)

A study by M. A. Shakal et al concluded that Rosetta SM Lithium disilicate at 0.5 and 1 mm Thicknesses recorded higher translucency values than Zirconia Lithium Silicate samples of same thicknesses, but at 1.5 mm Thicknesses translucency values for both materials were fairly similar.(36)

Color tends to strongly affect the appearance of the dental restorations. Surface roughness, texture, glossiness, and translucency also contribute to the overall aesthetics of the dental restoration. (36)

V. Conclusion

Within the limitations of this in vitro study the following conclusions could be drawn:
1. Lithium disilicate Ceramic materials thickness of 0.3 revealed higher translucency than 0.7 mm thickness.
2. Rosetta SM Lithium disilicate CAD showed higher translucency followed by IPS e.max CAD then Upcera CAD Blocks.
3.Translucency of three studied materials was affected by hydrothermal aging.

Clinical Recommendations:
In the scope of our study, Rosetta SM CAD Lithium disilicate veneers with Thicknesses 0.3 mm provide highest translucency.

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