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Research Article

EVALUATION OF EFFECTS OF DIFFERENT CORE AND VENEER THICKNESS COMBINATION ON TRANSLUCENCY OF TWO ALL CERAMIC SYSTEM: AN *IN VITRO* STUDY

BHUMIKA SANGTANI[1]*, KAVITA MARU[2], MANISH SANGTANI[3], ARCHITA GANGWAL[4]

[1]Citysmile Dental Clinic, Damoh, Madhya Pradesh, India. [2]Department of Prosthodontics, SAIMS and PGI, Indore, Madhya Pradesh, India. [3]District Hospital, Damoh, Madhya Pradesh, India. [4]Department of Dentistry, SAIMS & PGI, Indore, Madhya Pradesh, India. *Corresponding author: Bhumika Sangtani; Email: bhumika_dhalwani@yahoo.com

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ABSTRACT

Objectives: The study aimed to evaluate the effect of change in thickness of core or veneer ceramic on translucency of two types of Lithium Di Silicate Glass Ceramic IPS e-max PRESS and IPS e-max CAD.

Methods: A total of 56 disks (IPS e.max PRESS, IPS e.max CAD; Ivoclar Vivadent), 15 mm in diameter with different thicknesses (0.80 mm, 1.00 mm), were fabricated as core materials with the lost wax and heat-press techniques, according to the manufacturer's recommendations. They were divided into groups (n=7), the size of which was determined by power analysis (Δ=0.2; power=0.80; α=0.05). Each core material was veneered with its compatible veneer ceramic (IPS e.max PRESS, IPS e.max CAD. All surfaces were measured by profilometry to ensure consistency within the groups. A glass disk (1.5 mm) positive control (group P) and a metal core (1.5 mm) negative control (group N) were prepared. The translucency parameter (TP) values were calculated using spectrophotometry to calculate the color differences of the specimens over black and white backgrounds.

Results: IPS e.max PRESS and IPS e.max CAD depicted decreasing order or mean % transmittance as 0.15477 for IPS e.max PRESS (0.5+0.5), 0.14431 IPS e.max PRESS (0.8+0.2), 0.06671 IPS e.max CAD (0.5+0.5), 0.06297 IPS e.max CAD (0.8+0.2). The difference between these groups was found to be statistically significant ($p<0.05$). However, not significant difference found between Group 1 IPS e.max PRESS (0.8+02)-Group2 IPS e.max PRESS (0.5+0.5) and Group5 IPS e.max CAD (0.8+0.2)-Group6 IPS e.max CAD (0.5+0.5) pairs ($p>0.05$). One-way analysis of variance found significant differences among the TP values of the ceramic groups ($p<0.05$).

Conclusion: When overall thickness was increased to 1.5 mm, keeping similar veneer at 0.5 mm IPS e-max CAD exhibited better esthetic outcome than IPS e-max PRESS. Interaction of core and veneer are different with different ceramic systems at different thicknesses. Most appropriate ceramic material can be decided based only on specific clinical situation being faced.

Keywords: Core and veneer thickness, IPS e-max CAD, IPS e-max PRESS.

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INTRODUCTION

Esthetics signifies "natural beauty" a quality that comes from within [1]. The term Esthetics derived from the Greek word "aisthetikos" is the science that deals with beauty and philosophical theory of art [1]. Recent advances in ceramic system have revolutionised esthetic dentistry. Visual appearance of natural teeth depends on optical properties as enamel and dentine have natural translucency [2]. In order to stimulate natural teeth, a prosthesis should not only have same color as natural teeth but also same translucency. The translucencies of ceramic materials have been studied [3-5], and the effects of ceramic thickness [5-7], shade alternatives [8], different fabrication techniques, ceramic composition [9], surface texture [10] illuminants, and different crystalline structure affect translucency. Translucency is the relative amount of light transmission or diffuse reflection from a substrate surface through a turbid medium [11] and transmittance is a physical term which represents the ability of the medium to permit light to pass through it. Translucency indices like, total or direct transmission coefficient (TC), translucency parameter (TP), and contrast ratio are generally used [12]. Total transmission increases with increasing wavelength of light as mentioned by Rayleigh scattering equation. Transmittance is studied at 525 A° in accordance with Brodbelt's methodology of studying translucency of dental porcelain [13]. Small changes in thickness and shade of opaque and translucent porcelain layers can influence final shade of layered porcelain specimen. Heintze *et al*. [14] studied translucency of ceramic material in different core and veneer combinations by using different combinations of IPS e-max PRESS and IPS e-max Esthetic and concluded that total ceramic thickness affects translucency [14]. Although some studies have focused on TPs of core and veneer system and color parameters of core and veneer combinations [6,15]. No study till date has been reported to compare total transmittance of Lithium Di Silicate ceramics IPS e.max PRESS, IPS e. max CAD at different core and veneer thicknesses fabricated by two different procedures. Purpose of the study is to compare the effect of change in thickness of core and veneer in Lithium Di Silicate Ceramic IPS e-max PRESS and IPS e-max CAD and to investigate change in % transmittance between the two ceramics when keeping core thickness constant and changing veneer thickness while maintaining overall thickness and keeping veneer thickness constant and changing core while maintaining overall thickness. Null hypothesis was that the transmittance of ceramic would not be influenced by ceramic type or core and veneer thickness in combination of two types of glass ceramics.

OBJECTIVES

The study aimed to evaluate the effect of change in thickness of core or veneer ceramic on translucency of two types of Lithium Di Silicate Glass Ceramic IPS e-max PRESS and IPS e-max CAD.

METHODS

This is a comparative study conducted in the Department of Prosthodontics and Crown and Bridge at Sri Aurobindo College of Dentistry, Indore (M.P.) in association with Shreeji Analytical Laboratory, Indore (M.P). A total of

56 disks (28 disks) of IPS e.max PRESS and (28 disks) of IPS e.max CAD of 13 mm diameter and different thicknesses of core 0.5 mm, 0.8 mm and 1 mm were fabricated as per manufacturers recommendations and divided into group (n=7) the size of which was determined by power analysis. Each was veneered with its compatible veneer with different thickness 0.5 mm, 0.2 mm, 1.00 mm maintaining overall thickness of 1 mm and 1.5 mm. Thickness of both core and veneer were measured with digital caliper with accuracy 0.01 mm to ensure consistency within the groups. A glass disk (1.5 mm) was used as positive control.

Study was performed under following heading:

- Fabrication of IPS e.max Press Specimen
- Fabrication of IPS e.max CAD Specimen
- Veneering of both the specimen
- Specimen Thickness and grouping
- Evaluation of TPs using Spectrophotometer

Instruments:

- Lithium Di Silicate Glass Ceramic IPS e.max PRESS (28 disks) Ivoclar Vivadent
- Lithium Di Silicate Glass Ceramic IPS e.max CAD of 13 mm diameter (28 disks) Ivoclar Vivadent
- Digital caliper
- Glass disk

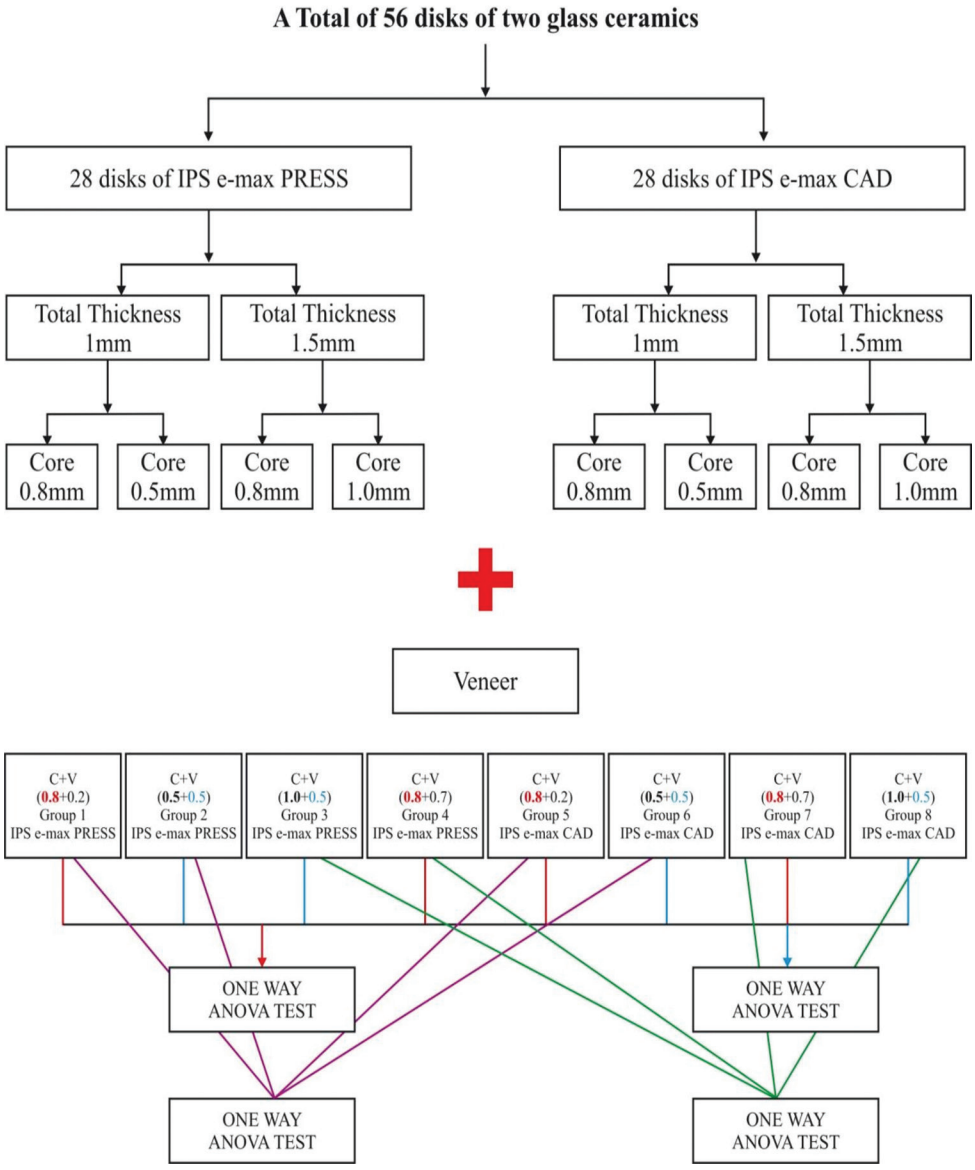
Data obtained were subjected to statistical analysis using and one-way analysis of variance analysis of variance (ANOVA) was applied and to find out pair wise comparison *post hoc* tuckey test was applied. Difference between groups to be statistically significant $p<0.05$. *Post hoc* test were applied for individual group comparison.

OBSERVATION AND RESULTS

Each IPS e. max Press and IPS e.max CAD specimen are grouped as follows:

Core material	Overall Thickness (1.5 mm)	Overall Thickness (1 mm)
IPS e.max Press (EP)	Core 0.8 mm Veneer 0.7 mm	Core 0.8 mm Veneer 0.2 mm
IPS e.max CAD (EC)	Core 0.80 mm Veneer 0.7 mm	Core 0.8 mm Veneer 0.2 mm

Here keeping core of same thickness constant for both the groups and maintaining overall thickness of 1.5 mm and 1.0 mm,



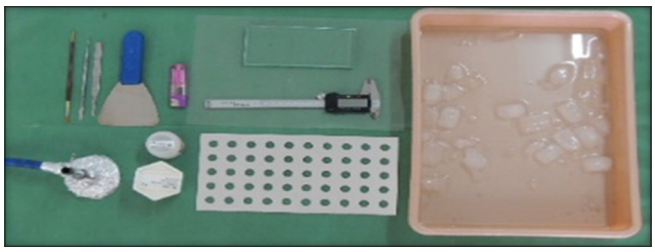


Fig. 1: Armamentarium to fabricate wax pattern

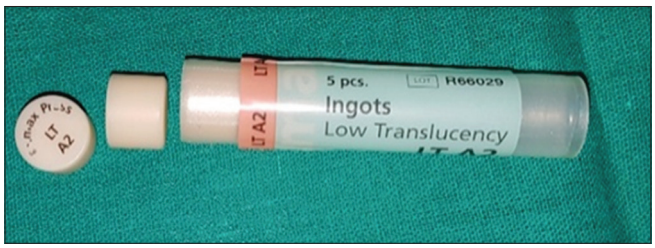


Fig. 2: IPS e-max PRESS ingots, Ivoclar Vivadent AG, Schaan, Liechtenstein

Fig. 3: IPS e-max CAD ingots, Ivoclar Vivadent AG, Schaan, Liechtenstein

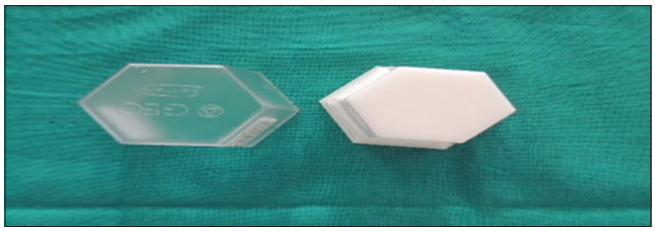


Fig. 4: IPS e-max ceram

respectively; specimen are grouped into n=7 (7 specimen per group).

Each IPS e. max Press and IPS e.max CAD specimen are grouped as follows:

Core Material	Overall thickness (1.5 mm)	Overall thickness (1 mm)
IPS e.max Press (EP)	Core 1 mm Veneer 0.5mm	Core 0.5 mm Veneer 0.5 mm
IPS e.max CAD (EC)	Core 1mm Veneer 0.5mm	Core 0.5 mm Veneer 0.5 mm

Here keeping veneer of same thickness for both the groups and maintaining overall thickness of 1.5 mm and 1.0 mm respectively; specimen are grouped into n=7 (7 specimen per group). Thickness of all the specimen is measured with digital caliper and average is calculated to ensure consistency within the group. On statistical analysis of data by comparing % transmittance of different combination of core and veneer in two different glass ceramic system, a significant difference was observed. Translucency of glass ceramics is dependent on thickness of material, overall thickness and thickness of core and veneer combination in both IPS e.max PRESS and IPS e.max CAD. On arranging both the glass ceramics mean % transmittance decreased in following order: Group 2 IPS e.max PRESS (0.5+0.5) 0.15477, Group 1 IPS e.max PRESS (0.8+0.2) 0.14431, Group 8 IPS e.max CAD (1.0+0.5)

Table 1 : Comparison of mean % transmittance on different types of ceramic system (IPS e.max PRESS and IPS e.max CAD) with constant core thickness and varying veneer thickness

Groups	Mean±SD	F-value	p-value
Group 1 IPS e.max PRESS Core: 0.8 mm Veneer: 0.2 mm	0.144±0.007	128.26	0.000*
Group 4 IPS e.max PRESS Core: 0.8 mm Veneer: 0.7 mm	0.081±0.005		
Group 5 IPS e.max CAD Core: 0.8 mm Veneer: 0.2 mm	0.063±0.011		
Group 7 IPS e.max CAD Core: 0.8 mm Veneer: 0.7 mm	0.106±0.008		

One-way analysis of variance applied. p=0.000, *Significant

Table 2: Comparison of mean % transmittance between different types of ceramic system (IPS e.max PRESS and IPS e.max CAD) with constant veneer thickness and varying core thickness

Groups	Mean±SD	F-value	p-value
Group 2 IPS e.max PRESS Core: 0.5 mm Veneer: 0.5 mm	0.154±0.005	255.41	0.000*
Group 3 IPS e.max PRESS Core: 1.0 mm Veneer: 0.5 mm	0.092±0.004		
Group 6 IPS e.max CAD Core: 0.5 mm Veneer: 0.5 mm	0.066±0.007		
Group 8 IPS e.max CAD Core: 1.0 mm Veneer: 0.5 mm	0.111±0.006		

One-way analysis of variance applied. p=0.000, *Significant

Table 3: Comparison of mean % Transmittance on different types of ceramic system (IPS e.max PRESS and IPS e.max CAD) with constant thickness of 1.5 mm and varying core and veneer thickness

Groups	Mean±SD	F-value	p-value
Group 3 IPS e.max PRESS Core: 1.0 mm Veneer: 0.5 mm	0.092±0.004	33.94	0.000*
Group 4 IPS e.max PRESS Core: 0.8 mm Veneer: 0.7 mm	0.081±0.005		
Group 7 IPS e.max CAD Core: 0.8 mm Veneer: 0.7 mm	0.106±0.008		
Group 8 IPS e.max CAD Core: 1.0 mm Veneer: 0.5 mm	0.111±0.006		

One-way analysis of variance applied. p=0.000, *Significant

Table 4: Comparison of mean % transmittance between different types of ceramic system (IPS e.max PRESS and IPS e.max CAD) with constant overall thickness of 1.0 mm and varying core and veneer thickness

Groups	Mean±SD	F-value	p-value
Group 1IPS e.max PRESS Core: 0.8 mm Veneer: 0.2 mm	0.144±0.007	254.15	0.000*
Group 2 IPS e.max PRESS Core: 0.5 mm Veneer: 0.5 mm	0.154±0.005		
Group 5 IPS e.max CAD Core: 0.8 mm Veneer: 0.2 mm	0.063±0.011		
Group 6 IPS e.max CAD Core: 0.5 mm Veneer: 0.5 mm	0.066±0.007		

One-way analysis of variance applied. p=0.000, *Significant

0.11173, Group 7 IPS e.max CAD (0.8+0.7) 0.1061, Group 3 IPS e.max PRESS (1.0+0.5) 0.09196, Group 4 IPS e.max PRESS (0.8+0.7) 0.08151, Group 6 IPS e.max CAD (0.5+0.5) 0.06617, Group 5 IPS e.max CAD (0.8+0.2) 0.06297. On comparing % transmittance of two different ceramic systems with a constant core thickness of 0.8mm and varying veneer thicknesses as 0.2 mm and 0.8 mm while maintaining overall thickness as 1.00 mm and 1.5 mm. Results of *post hoc* tukey showed a statistically significant difference seen in all the Groups. However, no significant difference found between Group 7 IPS e.max CAD (0.8+0.7) and Group 8 IPS e.max CAD (1.0+0.5) pair (p>0.05). Comparison of mean % Transmittance between different types of ceramic system (IPS e.max PRESS and IPS e.max CAD) with constant overall thickness of 1.0 mm and varying core and veneer thickness.

Above table shows that the result of one-way ANOVA depicted Mean % transmittance in decreasing order as 0.14431 IPS e.max PRESS (0.8+0.2), 0.1061 IPS e.max CAD (0.8+0.7), 0.08151 IPS e.max PRESS (08+0.7), 0.06297 IPS e.max CAD (0.8+02). (p<0.05). *Post hoc* tukey test revealed that there was statistically significant difference seen in all of the pairs (p<0.05). On comparing % transmittance of two different ceramic systems with constant veneer thickness of 0.5 mm and varying core thicknesses as 0.5 mm and 1.0mm while maintaining overall thickness as 1.00 mm and 1.5mm.

Above table shows that the result of one-way ANOVA resulted in Mean % transmittance in decreasing order as 0.15477 IPS e.max PRESS (0.5+0.5), 0.1113 IPS e.max CAD (1.0+0.5), 0.09196 IPS e.max PRESS (1.0+0.5), and 0.06617 IPS e.max CAD (0.5+0.5). (p<0.05). *Post hoc* tukey test revealed that there was statistically significant difference seen in all of the pairs (p<0.05). On comparing % transmittance of two different ceramic systems with varying core and veneer thickness combination but keeping a constant overall thickness as 1.5 mm.

In above table, the result one-way ANOVA identified Mean % transmittance in decreasing order as 0.11173 IPS e.max CAD (1.0+0.5), 0.10641 IPS e.max CAD (0.8+0.7), 0.09196 IPS e.max PRESS (1.0+0.5), and 0.08151 IPS e.max PRESS (0.8+0.7). Thus, Group 8 IPS e.max CAD (1.0+0.5) is most translucent and Group 4 IPS e.max PRESS (0.8+0.7) least.

In above table, the result for one-way ANOVA for IPS e.max PRESS and IPS e.max CAD depicted decreasing order or mean % transmittance as 0.15477 for IPS e.max PRESS (0.5+0.5), 0.14431 IPS e.max PRESS (0.8+0.2), 0.06671 IPS e.max CAD (0.5+0.5), and 0.06297 IPS e.max CAD (0.8+0.2). The difference between these groups was found to be statistically significant (p<0.05). However, not significant difference found between Group 1 IPS e.max PRESS (0.8+02)-Group2 IPS e.max PRESS (0.5+0.5) and Group5 IPS e.max CAD (0.8+0.2)-Group6 IPS e.max CAD (0.5+0.5) pairs (p>0.05).

DISCUSSION

This study was undertaken to evaluate the effect of different core and veneer thickness combinations of two lithium di silicate based glass ceramic IPS e.max PRESS and IPS e.max CAD on translucency. Brodbelt's *et al*., [16] studied transmittance of dental porcelain and found that the transmittance coefficient tc can be calculated after measuring transmittance by the equation $I/Io=tc^{x}$. "Io" is intensity of incident beam, "I" Intensity that passes through sample, x is thickness of sample and tc constant for material and is TC, which is ratio of incident beam and intensity of beam passing through a sample of unit thickness. Light passes through translucent material by direct transmittance and by scattering. The values of tc for direct transmittance and total transmittance (direct and diffuse) can be measured using appropriate spectrophotometer. Thus in present study, % transmittance was measured for each specimen of two glass ceramics IPS e.max PRESS and IPS e.max CAD. The transmittance of all the samples was studied at a wavelength of 525Å in accordance with Brodbelt's methodology of studying translucency of dental porcelains. Xiong *et al*. [17] had all specimens air abraded with 50 µm aluminum oxide at 3 bar to create a similar matte surface finish therefore in the present study, it was also decided to air abrade the surface of all specimens and standard polishing process was established to ensure that groups had consistent surface appearance. On comparing translucency of IPS e.max PRESS and IPS e.max CAD the present study clearly found that different core and veneer thickness combination present different translucencies, which is in agreement with previous studies that compared translucency of ceramic systems [8,12,18-21]. In present study mean value of % Transmittance decreased in order Group 2 IPS e.max PRESS (0.5+0.5) 0.15477, Group 1 IPS e.max PRESS (0.8+0.2) 0.14431, Group 8 IPS e.max CAD (1.0+0.5) 0.11173, Group 7 IPS e.max CAD 0.1061, Group 3 IPS e.max PRESS (1.0+0.5) 0.09196, Group 4 IPS e.max PRESS (0.8+0.7) 0.08151, Group 6 IPS e.max CAD (0.5+0.5) 0.06617, and Group 5 IPS e.max CAD (0.8+0.2) 0.06297. Hence, null hypothesis was rejected as there was significant difference in translucency of disks made of 2 Glass Ceramics by change in core and veneer thickness. O'Brien *et al*. [22] measured differences in color with different batches of the same porcelain system. The differences in color ranged from 0.55 to 3.38, which is considered not clinically perceivable, when 3.7 is taken as the color perception threshold (Johnston and Kao) [23]. Therefore, in the present study, specimens from the same group were fabricated with ceramic materials from the same manufacturer. In our study, it was attempted to use all ceramic groups with corresponding A2 shade of same manufacturer.

IPS e.max PRESS (0.8+0.2) is most translucent IPS e.max CAD (0.8+0.2) least. Hence keeping core thickness constant and changing veneer thickness and overall thickness IPS e.max PRESS (0.8+0.2) excellently simulate natural teeth by matching optical requirements of the tooth to be restored as % transmittance of natural teeth measured at nine locations by Fang Xiong17 was in the range of 0.13–0.65%. As the values of % transmittance of IPS e.max PRESS (0.8+0.2) was comparable as with natural teeth it can be used as ideal restorative material for anterior veneers and crown. On comparing the Mean Transmittance values, the mean transmittance for Group 1 IPS e.max PRESS (0.8+0.2) was 0.14431 and that of Group 5IPS e.max CAD (0.8+0.2) was 0.06297 which was statistically significantly less though overall thickness was 1.00 mm was maintained for both the ceramic system. This can be attributed due to the fact different chemical structure of ceramic system determine their optical properties. Though many systems have overlying porcelain for esthetics, core material has significant role for overall color of restoration and translucency. Thus on statistical results of present study it can stated that at thickness of 1 mm, IPS e.max PRESS (0.8+0.2) has more translucent core than IPS e.max CAD and transmits more light which in accordance with previous studies by Kursoglu *et al*. [19], Heffernan *et al*. [24] who fabricated the specimens were at 0.8 mm core thickness since it is the minimal thickness recommended by manufacturers in the middle third of a tooth receiving a porcelain veneer. He also stated that core material of

ceramic restorations depending on the composition comes in different degree of translucency and opacity.

In present study, IPS e.max CAD (0.8+0.7) has mean transmittance value of 0.1061 while that of IPS e.max PRESS (0.8+0.7) is 0.08151. As there is statistically significant difference between two glass ceramics when overall thickness was 1.5 mm it is due the fact that in IPS e.max CAD (0.8+0.7) after veneering has more crystals within the matrix and more compact crystal arrangement in IPS e- max CAD only a part of light is scattered and mostly is diffusely transmitted and thus it is more translucent. Increasing ceramic thickness improves resultant shade matching when fabricating lithium Disilicate restoration thus IPS e.max CAD (0.8+0.7) has better mechanical and optical property. This behavior of IPS e.max CAD can be explained by 16 by studying the micro structure of lithium Disilicate ceramic. IPS e.max CAD has two crystal types and two micro structures that provide its unique properties during each phase of use. IPS e.max PRESS specimen with constant core of 0.8mm and varying veneer as 0.2 mm and 0.7 mm were compared and mean transmittance was 0.14431 of IPS e.max PRESS (0.8+0.2) and that of IPS e.max PRESS (0.8+0.7) was 0.08151. By keeping core constant and changing veneer thickness, a statistically significant difference between core and veneer thickness combination of same glass ceramic was found. It can be stated that when overall thickness decreases the crystal volume decreases and core material has greater effect on translucency and it transmits more light. Furthermore opacity of all core specimen increases after veneering because of the structure of veneering porcelain, increased specimen thickness, reflectance at interface between core and veneering porcelain. Thus application of veneer 0.7 mm in IPS e.max PRESS (0.8+0.7) specimen increases the total thickness and affects the transmission of light. Difference in color reproduction by combination of core and veneer in clinically allowable thicknesses makes IPS e.max PRESS (0.8+0.2) a better restorative material of choice for anterior esthetics. This behavior of IPS e.max PRESS can be explained from previous studies where in an *in vitro* study by Kursoglu *et al*. [19], it was concluded that the effect of veneer material should be considered during preparation of ceramic restoration and also said when total thickness decreases the core has more effect on translucency than veneering material. Pandey and Kolarkar [25] in accordance with this in result of her study found that ceramic veneering material IPS e.max Ceram (IPS e.max Press Ivoclar Vivadent veneering material) has nano-fluoroapatite and micro-fluoroapatite crystals. They cause light scattering in a way that resembles scattering by structure and components of tooth enamel Xiong *et al*. [17] said variation in translucency is due to difference in crystal volume and refractive index. Conversely, the mean transmittance was 0.1061 for IPS e.max CAD (0.8+0.7) and 0.06297 for IPS e.max CAD (0.8+0.2). Mean difference in transmittance value was statistically more in IPS e.max CAD specimens (0.8+0.7) when IPS e.max CAD specimen with core thickness constant at 0.8 mm with varying veneer of 0.2 mm and 0.7 mm were compared. Most probable reason for this is there is more compact arrangement of crystals in IPS e.max CAD and material is composed of smaller particles are less opaque when visible light passes through, with less refraction and absorption in spite of greater scattering from increased number of particles. Veneering ceramic IPS e.max Ceram has nano-fluoroapatite and micro-fluoroapatite crystals. When overall thickness increases, there is more compact arrangement crystals in both of IPS e.max CAD core and veneer with greater thickness, and thus, they transmit more light as light is not diffusely scattered from the crystals. This at clinical recommended thickness of 1.5 mm IPS e.max CAD exhibit better esthetic outcome. The behavior of IPS e.max CAD can be explained from previous studies by Lee *et al*. [26], Shokry *et al*. [12], in their study concluded that translucency is not only affected by core thickness alone but also with their interaction. In present study the mean of % transmittance IPS e.max PRESS (0.5+0.5) is 0.15477 and IPS e.max CAD (0.5+0.5) is 0.06617 a marked statistical difference is found though overall thickness is 1.00 mm for both the glass ceramic system. Though both the systems have a constant veneer of 0.5 mm and shade and translucency of veneer contribute to color characteristic of definitive restoration but major concern of restoration relies on core which offer excellent strength to overlying restoration also translucency of core varies with different ceramic system. IPS e.max PRESS (0.5+0.5) has a translucent core than IPS e.max CAD (0.5+0.5) and is a preferred material of choice for anterior restorations as it simulates natural teeth to a great degree. The results of the present study is in accordance with Kursoglu [19] stated that core material of ceramic restorations depending upon the composition comes in different degree of translucency and opacity [27]. As IPS e.max PRESS has various metal oxides that are not color stable during firing. Due to additional firing after applying veneering ceramic, there is change in constituent and thus increases its opacity and transmits less light. This optical behavior of IPS e.max PRESS can be attributed from previous studies where Pandey and Kolarkar [25] in her study found that the Opacity of core specimen increases after veneering because of the structure of veneering porcelain, increased specimen thickness, reflectance at the interface between core and veneering porcelain, porosity between the layers, and any change in the constituent with additional firing. However veneering material, that is, IPS e.max ceram contains nano-fluoroapatite crystals (<300 nm in length and approx. 100 nm in diameter) which is claimed to be similar to natural teeth. So when veneering material is applied over the core disks. Antonson *et al*. [18] in his study evaluated translucency of human teeth and ceramics and found that ceramics have magnesium titanate in its composition which gets precipitated during ceramming and is important factor in decreasing total transmittance. In present study, when veneer was kept constant at 0.5 mm mean transmittance value of two thicknesses of IPS e.max PRESS (1.0+0.5), overall thickness 1.5 mm was 0.09196 and of IPS e.max PRESS (0.5+0.5) 0.15477 with overall thickness as 1.00 mm and statistically significant. The statistically significant result can be explained from previous studies where Xiong *et al*. [17], Ozturk *et al*. [28] found that translucency of ceramic material depends on scattering of light within bulk material. The amount of light reflected, absorbed, and transmitted depends on material composition, number of particles and pores and sizes of particle and pore compared to incident wavelength of light. A slight significant difference is found when mean transmittance of IPS e.max CAD (0.8+0.7) i.e. 0.10641 is compared with IPS e.max CAD (1.0+0.5) i.e. 0.11173 As described earlier that translucency of ceramic material is dependent on scattering of light in bulk material. The amount of light reflected, absorbed and transmitted dependent upon materials chemical composition and interaction between core and veneer. Thus for IPS e.max CAD at overall thickness of 1.5 mm whatever be the composition of core and veneer the transmittance value is not different because of compact arrangement of crystal particles and similar reflectance at interface between core and veneering porcelain and no change in constituent of IPS e.max CAD with additional firing cycle. This is in accordance with previous study by Harianawala [29]. In the present study, use of only two ceramic materials and two thicknesses is a limitation to this study as different results can be obtained with different types of ceramics and at different overall thicknesses. There was tendency of veneering material to delaminate from the core and this resulted in additional repair firing. Furthermore as repeated firing changes the constituents of core material and hence affects it transmittance; therefore, further studies on effect of repeated firing on core and veneer thickness combination needs to be undertaken. Monolithic restorations offer different range of transmittance and require reduced amount of tooth preparation, thus promotes conservative tooth preparation. The effect of monolithic restorations on translucency is another idea of research. Clinical relevance of study is somewhat limited due to complexity of Spectrophotometer. As same results cannot be obtained on calorimetric evaluation of samples, hence a future perspective to develop an instrument functional in clinical setting and used as a color guide to determine final shade of all ceramic restoration needs to be undertaken.

CONCLUSION

Our study findings concluded that translucency of glass ceramic system is correlative to material + thickness + core and veneer thickness combination. When overall thickness decreases, IPS e-max PRESS exhibits greater translucency close to that of natural teeth (0.13%–0.65%) than IPS e-max CAD. With greater overall thickness

of the restoration, IPS e-max CAD exhibits better translucency. On total reduction of 1 mm for IPS e-max PRESS, a thinner core is more translucent and there is no significant effect of veneering ceramic over the core on translucency. However, IPS e-max CAD at 1 mm of total thickness has lower transmittance. On considering IPS e-max PRESS (1.0+0.5), IPS e-max PRESS (0.8+0.7) here is an inverse relationship between thickness of veneering ceramic and transmittance of IPS e-max PRESS specimen. At thickness of 1.5 mm thicker core is more translucent. When overall thickness was increased to 1.5 mm, keeping similar veneer at 0.5 mm IPS e-max CAD exhibited better esthetic outcome than IPS e-max PRESS. Interaction of core and veneer are different with different ceramic systems at different thicknesses. Most appropriate ceramic material can be decided based only on specific clinical situation being faced.

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CONFLICTS OF INTEREST

None declared.

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