MJMR, Vol. 34, No. 2, 2023, pages (195-201)

Open Access
ISSN: 2682-4558

Research Article

Efficacy of try-in paste and resin cement shades in prediction of the Final Color of multilayer Zirconia Veneers (An In-Vitro Study).

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DOI: 10.21608/mjmr.2023.187877.1306

Abstract

Objectives: Aimed to study the efficacy of using try- in paste resin cement shades, in prediction of the final perceived color of Cercon Veneer. **Material and Methods:** tetragonal zirconia polycrystal stabilized with 5 mol% yttria and 9 wt.% yttria, Variolink Esthetic (LC) System kit for resin cement, and tetric N-ceram composite resin. A total of thirty CAD/CAM Cercon disks (diameter = 10mm), shade A2, and thickness of 0.5mm (n=30) fabricated. The ceramic groups were ordered into three subgroups, n=10 for each, according to the shade of luting cement used, then each subgroup ordered into two equal classes n=5 for each, according to the type of cement (final cement or try in paste). Thirty samples of resin background disks fabricated using a Teflon mold (10 x 3) mm to acquire a uniform background to resemble the prepared tooth substrate. The specimens' color was assessed by fixing them onto a grey background. Color parameters assessment was performed utilizing a spectrophotometer according to the CIE Lab color system. Results were then statistically analyzed using Shapiro-Wilk test to assess the normality of distribution, and two-way Anova. **Results:** One way ANOVA test used for quantitative data between the 3 groups succeeded by post hoc LSD analysis between each two groups in 0.5 mm thickness, there was significant increase in ΔE in light shade compared with natural shade. there was insignificant difference between others. **Conclusion:** Caution should be taken when using a try-in paste to determine the final restoration's color and addition test should be done.

Keywords: cements, try in-paste, thickness, zirconia

Introduction

There has been a dramatic rise in the use of veneer restorations for aesthetically compromised anterior teeth in recent years. Veneers surpass composites in terms of their advantages, which include remarkable biocompatibility, reliable rate of clinical success and natural appearance. [(1)] Nowadays, all-ceramic FPDs employ zirconium oxide as their core material, particularly with addition of yttrium oxide. There has been an increase in the availability of predictable treatment options for both the anterior and posterior areas with the advent of zirconium oxide based, all-ceramic FPDs. In addition to that, zirconium-oxide blanks, either partly or entirely sintered, may be used in conjunction with technology of CAD/CAM to fabricate frameworks/copings. [(2)] Cercon is Zirconia (zirconium dioxide) that is a white, powdered metal oxide. It's a ceramic, much like most other options for

dental crowns. It has been shown by clinical studies that veneer restorations are characterised for having high rates of success. Although it is challenging to attain optimal esthetics when using veneer restorations, which commonly includes color alteration along with limitation in enamel preparation. It has been indicated by some research that the esthetic result of porcelain veneers was influenced by both the opacity and translucency of the ceramic, the color of the underlying structure of the tooth and the color of the luting materials.

In most cases, a thin translucent porcelain bonded to an undiscolored tooth may provide a desirable esthetic result. Nevertheless, dentists usually rely on using resin cements to cover the underlying color as well as enhancing the appearance of final restoration when a porcelain veneer does not match the color of the surrounding teeth. But it has been reported by others that the existence of the cement changed the color of the all-ceramic restoration to a degree characterised for being clinically detectable 8-10, particularly following the accelerated aging. The incisal third of the restoration was unaffected by the cement shade, whereas the body and/or cervical portion was affected, depending on the material of restoration.

Therefore, commercially accessible systems of resin cement are including the corresponding developed water-soluble try-in paste for use in making a preliminary selection of shade of the suitable composite resin cement. Various shades of resin cement were offered by the manufacturers, that aid the clinicians in the process of choosing the suitable shade of cement for ceramic veneers to acquire the required esthetics. [(7)] The try-in paste, accompanied with resin cement aid both patient and clinician to assess the shade match and shape of veneer restoration to determine whether the desired aesthetic results can be attained or not. Attributing to the fact that cercons are translucent materials like ceramics, they may also be affected by the previously mentioned factors.

Nevertheless, there was a lack of information in terms of how different shades of resin cement affect the final color of cercon restorations. Thus, studying was to study the efficacy of using try- in paste resin cement shades, in prediction of the final perceived color of Cercon Veneer were the objectives of this study.

Materials & Methods:

Materials were used: tetragonal zirconia polycrystal (5Y-TZP) stabilized with 5 mol% yttria and 9 wt.% yttria (Cercon® xt ML shade A2 – 18) Dentsply Sirona USA, resin cements and try in pastes system (Variolink Esthetic (LC) System kit. Ivoclar Vivadent) and Composite resin (Tetric N-Ceram shade A2).

Sample grouping:

According to the sample size calculation, a total of thirty CAD/CAM Cercon disks of the same color shade, A2, were divided in to three equal groups (ten for each) n=10 according to the shade of the cement used: Group (I): cercon discs 0.5 thickness cemented by light shade n=10, Group (II): cercon discs 0.5 thickness cemented by neutral shade n=10, Group (III): cercon discs 0.5 thickness cemented by warm shade n=10.

Ultimately, each subgroup was splitted into two equal classes (five for each) n=5 according to the type of cement whether final cement or try in paste: class I: n=5 cemented by final cement. class II: n=5 used the corresponding try in paste.

They have been undergone color measurement after curing the samples that cemented by the final cement.

Sample preparation:

The samples of resin background disks fabricated using a Teflon mold (10mm x 3mm) to attain a uniform background and utilised as the color of background to resemble the substrate of the prepared tooth. CAD/CAM Cercon discs of the same color shade, A2, were designed by sirona blender software in thickness of 0.5mm for all the 30 samples. (Figure 1) Then milled by sirona inlab CAM software by sirona MC x5 milling bur in inLab MC x5 milling machine. All Cercon disks were sintered in a sintering furnace (inlab Profire for

sintering Cercon). Then we used High flu glaze for cercon to glaze cercon Xt ML and we used Multimat Cube press (Dentsplay Sirona) machine.

Application of the try-in paste was carried out between the sample of cercon and composite substrate. In order to attain a uniform film thickness of try-in paste, a pressure of 500 g for 10 s was loaded over the cercon sample. Afterwards, removal of the try-in paste was carried out from the specimens using a flat-angled brush.
Then three different shades of resin cement were directly applied between the Cercon discs with 0.5 mm thicknesses and composite substrate as follow: warm, neutral, and light.

Compressive pressure (500 g) was applied on the Cercon discs for 10 seconds and then the load removed, and excess cement removed by brush and specimens were light polymerized with a light-curing unit.

Before final cementation, composite substrate samples surfaces treated. All Composite samples treated from one surface with 37wt.%in water acid etch (Etch N vivadent ivoclar) and then adhesive material applied, and then light polymerized for 10s.

Three different shades of resin cement were directly applied between the Cercon discs with 0.5 mm thickness and composite substrate as follow: warm, neutral, and light. Compressive pressure (500 g) was applied on the Cercon discs for 10 seconds and then the load removed, and excess cement removed by brush and specimens light polymerized with a light-curing unit.

Evaluation of Color:
the color of specimens was projected onto a grey background in order to assess the color. The CIEL ab system of color using spectrophotometer was used in order to evaluate the parameters of color.

Cary 5000 Spectrophotometer supplied from Agilent Technologies (USA) was the used apparatus in measurements. Manufacturing of Agilent Cary 5000 UV-Vis-NIR spectrophotometers is performed in accordance with quality management system certified to ISO 9001.

E units are used to express the degree of color difference between the compared colors. The overall color difference, in accordance to L*, a*, b* coordinates, is calculated as demonstrated in the following equation: $\Delta E^{*} = ((\Delta L^{*})^{2} + (\Delta a^{*})^{2} + (\Delta b^{*})^{2})^{1\backslash 2}$

Results

Statistical analysis:

SPSS program (Statistical Package for Social Sciences) software version 25 was used to code, tabulate, and statistically analyse the collected data. Creation of charts was performed using Microsoft office, excel, 365. Normality of distribution was checked using Shapiro-Wilk test.
For parametric (normally distributed) quantitative data, descriptive statistics were performed using the mean, standard deviation (SD), and maximum and minimum of range. Two Way ANOVA test was used to determine the effect of shades, thickness, and interaction between both on Δ E. Analyses were performed between the two groups for parametric quantitative data using Independent Samples T test. Analyses were done between the Three groups for parametric quantitative data using One Way ANOVA test succeeded by Post Hoc LSD analysis between each two groups. The level of significance was determined at (P value ≤ 0.05).

Table (1): Two-way ANOVA analysis the ΔE between try in paste and final resin cement of different shades in thickness of 0.5 mm:

0.5 mm thickness		Shades			P value
		Warm	Neutral	Light	
		N=10	N=10	N=10	
ΔE	*Range* *Mean ± SD*	(1.6-2) 1.9±0.3	(1.4-1.8) [a] 1.6±0.1	(1.8-2) [b] 2±0.2	***0.045****

- **One way ANOVA test for quantitative data between the 3 groups followed by post hoc LSD analysis between each two groups**
- **Superscript with different small letters refer to significant difference between the 2 groups**
- ***: Significant difference at P value < 0.05**

Comparison of ΔE between different shades in thickness of 0.5 mm showed that ΔE was highest with light shade, followed by warm shade and finally neutral shade. There was significant increase in ΔE in light shade compared with neutral shade (P value < 0.05). Otherwise, there was insignificant difference between other shade types. (Figure 2)

Figure (1): Cercon discs of the same color shade, A2, were designed by sirona blender software in thickness of 0.5mm.

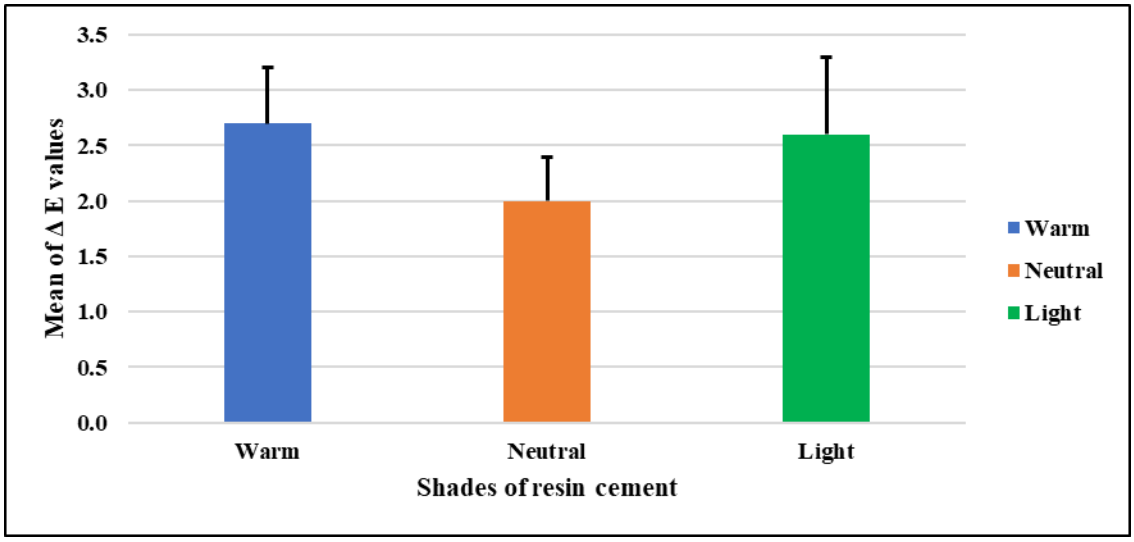

Figure (2): Histogram of Comparison of ΔE between different shades in thickness of 0.5 mm

Discussion

Extra transparent zirconia is defined as tetragonal zirconia polycrystal (5Y-TZP) stabilized with 5 mol% yttria and 9 wt.% yttria. Cercon XT The latest versions of translucent zirconia are adaptable and can be utilized for a variety of restorations, including monolithic crowns, veneers, and attractive anterior restorations.[1 2 3]

However, there are no studies evaluating the color matching between the try-in paste and their related resin cement or using this new material for ultra-thin veneers and assess the effect of resin cement different shades on its color parameters. [58] In this investigation, extremely transparent yttrium-stabilized zirconia (cercon xt) was chosen among the dental ceramics.

Manufacturers of light-cured resin cement make cementation kits with try-in paste and related resin cement to help physicians in selecting the best color match for patient satisfaction. It would be ideal if manufacturers could have more time to work with the ceramic laminate veneers during the try-in process by creating a try-in paste with a structure like the resin cement used to adhere ceramic laminate veneers but without any polymerization (curing) capabilities. As a result, ideal color matching is accomplished. To mimic the aesthetic qualities of the light-cured resin cement, the try-in paste is strengthened with filler and colors. [7]

A spectrophotometer calculates and records the amount of visible radiant energy that an object reflects or transmits for each value, chroma, and hue found in the complete visible spectrum, one wavelength at a time. An innovative spectrophotometer is a highly accurate dental color analysis equipment that enables highly accurate color measurement based on spectral estimate using an LED light source.[4]

The CIELAB color coordinate system was used to measure color parameters against a grey background, which can be thought of as a neutral background and eliminates the impact of background shade on sample color. [5] According to **Kulkarni et al 2020** [6] color difference was calculated based on the CIElab system for the analysis of color changes (ΔE) using the following equation :$\Delta E = ((\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2)^{1\backslash 2}$

The equation
$\Delta E^* = ((\Delta L^*)2 + (\Delta a^*)2 + (\Delta b^*)2)1\backslash 2$
describes the overall color difference. According to a number of studies, 50% of human viewers can visually identify color variations higher than one unit (ΔE>1), and the general public can recognize color differences of value

ΔE>3.3, which can be regarded as clinically significant. [7 8]

Color difference (ΔE) represented the numerical distance between L*, a*, and b* coordinates of two samples colors in color space according to **saba et al 2017**. [9]

The current study results showed that when comparing the ΔE between try in paste and their corresponding resin cement of various shades with a thickness of 0.5 mm, light shade had the greatest ΔE, followed by warm shade, and finally the neutral shade. When compared to neutral shade, the ΔE significantly increased (P value < 0.05). Other from that, the differences between other shade categories were insignificant. So that There was significant difference in ΔE in light shade (P value < 0.05). Otherwise, there was insignificant difference between other shade types with the ultrathin veneer thickness (0.5mm).

Different ratios of the cement's "ingredients" for opacity could explain why different colors of resin cements have different color differences. The inorganic fillers in the material represent a phase that has a different refractive index from the material's bulk, which causes light to scatter and have varying degrees of translucency. Additionally, the amount of translucency affects the final hue as well as the degree of chroma: Low chroma colors had a more transparent quality. [10]

This might be because of the light shade having a higher (L) value and brightness but less chroma. In comparison, the warm shade has a lower L value, brighter color, and more chroma. Additionally, as cement polymerizes, it takes on a somewhat deeper color and produces more chemical linkages in the matrix, which are more noticeable in lighter tints. These findings were in line with those of M **M. Q. AlQAHTANI, et al. 2012** [11].'s study, in which it was determined that using various shades of resin cement had an impact on the E values of ceramic specimens.

Finally, it appeared that translucent cement did not greatly alter restoration colour because the neutral shade, which is the most translucent one, had no effect on it. With feldespathic porcelain, 0.5 mm in thickness, employing opaque cement **S. Zeighami, et al. 2017** [12] and **D. Kürklü, et al., 2013** [13] indicated an increase in ΔE; however, in greater thicknesses, no significant difference was detected between the opaque and translucent cements. The restoration colour does not seem to be significantly affected by translucent cement.

Various internal or external factors may also contribute to the observed color performance. Aspects that are intrinsic have to do with compositional differences, physical-chemical interactions between resin cements and try-in, or the oxidation of left over monomers in resin cements. [1415]

As a result, the initiator, the quantity and type of monomer, and the efficiency of the light-curing can all have an impact on the color correspondence. Light-curing may also significantly affect color changes since a higher degree of conversion reduces the amount of residual monomer that is available for the production of colorful degradation products. [16]

The heterogenity in reported findings was potentially due to variances in materials and its composition (that vary in quantity of colorant ingredients), brands, shades, thickness of ceramic, thickness of cement space, material. curing mode (light/dual cure) and methods used for assessment of color.

According to the previous results the null hypothesis of this study which said there was no difference between try-in paste and final luting resin cement in relation to the final perceived color of Labial laminate veneers constructed of CAD/CAM, XT multilayer Cercon esthetic material was partially rejected.

Conclusions:

Within the limitation of this study, the following conclusions could be drawn:

1. The final color of the cercon xt laminate veneer is influenced by the shade of the resin cement.

2. Caution should be taken when using a try-in paste to determine the final restoration's color and that additional testing should be done with the resin applied before curing.

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