Influence of resin cement: In vitro color changes

Pereira, J.*[1], Reis, J.A.[1], Martins, F.[1], Fuentes, V.[2], Maurício, P.[1]

1.Instituto Universitário Egas Moniz
2.Universidad Rey Juan Carlos

Introduction

The reproduction of the color of an anterior tooth presents itself as one of the greatest challenges in aesthetic dentistry. The process of reproduction of the chosen final color is dependent on several factors: the characteristics of the ceramic system used, the change of thickness, type of ceramic, substrate and cementing agent[1]. In 1976, the CIE defined a color space, the CIE Lab, which supports the accepted theory of color perception based on three separate color receivers in the eye: red, green and blue. The CIE Lab represents a uniform color space, with equal distances, corresponding to equal color perception differences. In this three-dimensional color space the three axes are L *, a * and b * [2] (Figure 1).
Advances in technology have allowed the development of various color-matching electronic instruments available for clinical use[3]. In Dentistry the most widely used are colorimeters and spectrophotometers, which define the color of the tooth by measuring the amount of spectral composition of reflected light on the surface of the tooth[4].

Objective

To evaluate in vitro color changes caused by different cementing materials, varying the thickness of the ceramic.

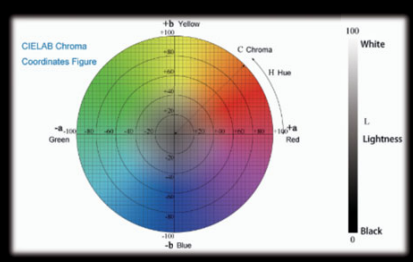


Figure 1 : CieLab, color space.

Materials and Methods

Lithium disilicate ceramic blocks IPS e.max Press HT (Ivoclar Vivadent, Schaan, Liechtenstein) color A2 (Figure 2) were used for the production of 40 ceramic samples with a thickness of 0.5mm.
40 discs of FiltekTM Supreme XTE A3 Body Shade composite resin (3M ESPE Minnesota, USA) were produced through a resin former, with a constant thickness of 1mm, for a total of n = 40.

Figure 2 : IPS e-max Press HT ceramic (Ivoclar Vivadent, Schaan, Liechtenstein) color A2.

After the process of obtaining and calibrating the samples the surface treatment of the dissilicate ceramic samples was carried out with hydrofluoric acid (PulpDent® Corporation, Massachusetts, USA); orthophosphoric acid (R & S, France); silane and bond (Optibond FL, Kerr, Italy).
The ceramic samples were cemented to the resin composite with the resin cements: RelyX Veneer B0.5 and A3 colors (3M ESPE, Seefeld, Germany) and Variolink Esthetic (Ivoclar Vivadent, Schaan, Liechtenstein) light and Warm colors.

The data corresponding to the color analysis were obtained with reflection spectrophotometry.
The spectrophotometer used was Spectro Shade ™ (MHT S.p.A., Italy). All readings were performed on the same background (gray).

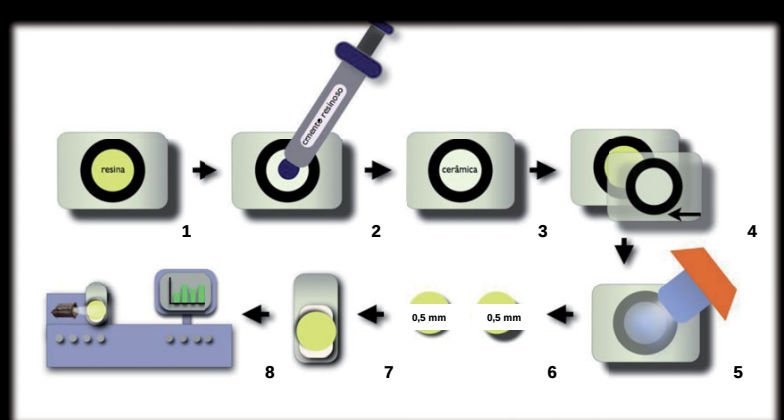


Figure 2: Diagram of the work methodology. A silicone mold was used as a mold for manufacturing the composite resin discs (1); placing the resin cement on the composite resin (2); placing the ceramic on the resin disk (3); pressure was applied in order to obtain a uniform thickness (4); polymerization of the sample (5); four study groups with a ceramic thickness of 0.5 mm were obtained (6); the samples were marked for later identification (7); each sample was placed on a carrier and read in the spectrophotometer (8).

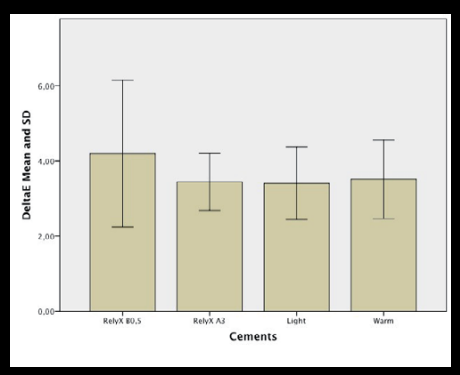
The color differences between each sample (Delta E) were recorded with the L * a * b * system of CIELab (Comission Internationale de l'éclairage). (Figure 2)
For statistical analysis, one-way ANOVA was used, for a significance of p <0.05.

Results

Delta E

	Average	Standard Deviation
RelyX Veneer B0,5	4,1942	1,95669
RelyX Veneer A3	3,4400	0,76063
Variolink Esthetic Light	3,5067	0,96472
Variolink Esthetic Warm	3,636	1,04567
	p= 0,464 (a)	

Table 1: Delta E (average and standard deviation).
(a) One-Way ANOVA.



Graphic 1: Delta E

Discussion

The value of Delta E from which color changes are perceptible at clinical level is not consensual in the literature, with values ranging from 1.70 to 6.805. Douglas, Steinhauer & Wee [6] concluded that the Delta E interval that was clinically discernible by 20 dentists ranged from 1.7 to 2.7. In this study, it was defined that when Delta E <1.7 the color difference is not clinically perceptible. For values of Delta E> 1.7 the change is already clinically visible.
The results obtained were not statistically significant for the cements used. However, all Delta E values were greater than 1.7, which means that all the cements used will cause a variation in the final color of the rehabilitation.

Conclusion

The fact that the cements do not show statistically significant differences does not imply that these differences are not clinically perceptible.

Clinical Implications

The optical properties of the cements are as important as those of the ceramic, as the aesthetics of the ceramic restoration depends on the type of cement used.

Bibliography

1. Stevenson B, Ibbetson R. The effect of the substructure on the colour of samples/restorations veneered with ceramic: a literature review. Journal of Dentistry, 2010;38:361-8. 2. Joiner, A. Tooth color: a review of the literature. Journal of Dentistry, 2004; 32:3-2. 3.Öztürk, E., Chiang, Y.-C., Coşgun, E., Bolay, Ş., Hickel, R. e Ilie, N. Effect of resin shades on opacity of ceramic veneers and polymerization efficiency through ceramics, *Journal of Dentistry, 2013;41*(5), 8-14. 4. Vichi, A., Louca, C., Corciolani, G. e Ferrari, M. Color related to ceramic and zirconia restorations: A review. *Dental Materials, 2011; 27*(1), 97-108. 5. Chen, X. D., Hong, G., Xing, W. Z. e Wang, Y. N.The influence of resin cements on the final color of ceramic veneers. *Journal of Prosthodontic Research, 2015; 59*(3), 172-177. 6. Douglas, R. D., Steinhauer, T. J. e Wee, A. G. Intraoral determination of the tolerance of dentists for perceptibility and acceptability of shade mismatch. *The Journal of Prosthetic Dentistry; 2007; 97*(4), 200-208.