Fluorescence of feldspathic ceramic and flowable resins

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Introduction

The aesthetic outcome of a ceramic veneer is determined by the color and thickness of the ceramic, the cement and dental substrate color[1,2]. The color reproduction of the teeth can be optimized by their secondary optical properties such as translucency, opalescence and fluorescence[3]. Fluorescence consists of the absorption that a sample makes in the ultraviolet spectrum of light (UV) and the spontaneous emission of light visible in the bluish spectrum[4,5]. Nowadays there are several veneer cementation materials like light cured resin cements, flowable resins and conventional resins cements. Currently flowable resins have the lowest polymerization shrinkage results[6].

Objective:

To evaluate in vitro the fluorescence changes of the feldspathic ceramic when used with different flowable resins, varying the thickness of the ceramic.

Materials and methods

Figure 1: Feldspathic ceramic CEREC Blocs, Sirona

Figura 2: Filtek Supreme XTE Body Color A3

Figura 3: G-aenial Universal Flo

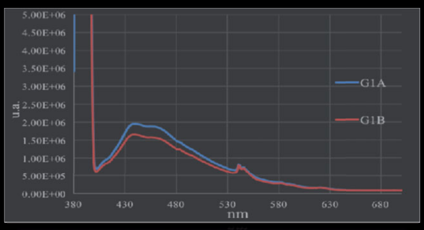


Figure 4: Fluorescence spectrum

Cerec Blocs C / PC color A2 blocks (VITA Zahnfabrik Spitalgasse, Germany) were used for the production of 60 ceramic samples of two different thicknesses: 0.5 and 0.8mm, which were cut using a microtome (ISOMET 1000, Buehler®, Lake Bluff, IL, USA), with a diamond disk cooled with deionized water at constant speed (450 rpm). The ceramic samples were polished following a 400, 600 and 1200 (Bulher®, Lake Bluff, IL, USA) sanding sequence for 15 seconds using a polisher (LabolPol-4, Stuers, Spain).

Sixty discs of Filtek™ Supreme XTE A3 Body Shade (3M ESPE Minnesota, USA) (Rc) were produced using a resin former (Porcelain Sampler, Ref. 7015, Smile Line, Switzerland), with thickness of 1mm and light cured (EliparTM, 3M, Saint Paul, USA) for 20 seconds at 1000mw / cm^2 light intensity, according to the manufacturer's instructions.

Surface treatment of the ceramic samples was carried out with hydrofluoridric acid (PulpDent® Corporation, Massachusetts, USA); orthophosphoric acid (R&S, França); silane and bond (Optibond FL, Kerr, Itália).

The ceramic samples were then bonded to the composite resin using G-aenial Universal Flo (GC Europe, Leuven) A2 and A3, with a constant pressure of 50 Newtons for 60 seconds and light cured for 60 seconds with photopolymerizer.

After the adhesion process, the samples were placed in a dry environment, protected from light and at room temperature, for a period of 24 hours. Fluorescence analysis was made with a Spex spectrofluorometer (Fluorolog® 2I2I) at a standardized wavelength of 380 nm at room temperature. To standardize the readings a custom build support was made.

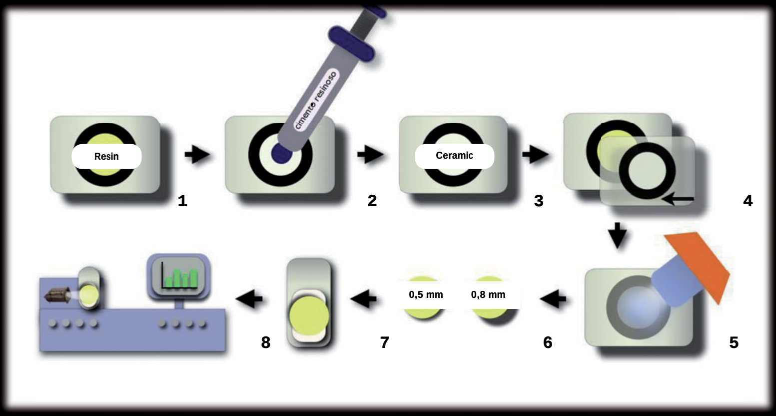
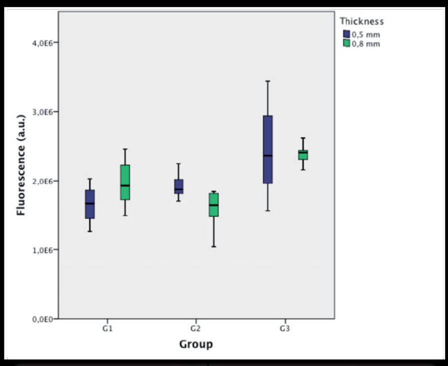


Figure 5: Diagram of the work methodology. A silicone mold was used as a mold for manufacturing the composite resin discs (1); placing the flowable resin on the composite resin (2); placing the ceramic on the resin disk (3); pressure was applied in order to obtain a uniform thickness (4); polymerization of the sample (5); two study groups with ceramic thicknesses of 0.5 and 0.8 mm were obtained (6); the samples were marked for later identification (7); each sample was placed on a carrier and read on the spectrofluorometer (8). For the statistical analysis, two-way ANOVA was used, for a significance level of p <0.05.

Results



Graphic 1: Maximum fluorescence intensity.

	Ceramic thickness (mm)		
Group	A - 0,5	B - 0,8	
G1	1,65E06 ± 2,49E05	1,95E06 ± 3,08E05	p=0,050 (a)
G2	1,91E06 ± 1,73E05	1,59E06 ± 2,53E05	p=0,083 (a)
G3	2,47E06 ± 6,20E05	2,40E06 ± 1,33E05	p=0,004 (a) (*)
	p<0,001 (a) (*)	p<0,001 (a) (*)	

(a) Two-way ANOVA

(*) Identifies a statistically significant difference for a 95% confidence interval

Table 1:Fluorescence intensity. (a.u.) (medium ± standard deviation).
G1A: control group of ceramic with 0,5 mm thickness ; G1B: control group of ceramic with 0,8 mm thickness; G2A: G-aenial flo A2, 0,5 mm thickness; G2B: G-aenial flo A2, 0,8 mm thickness; G3A: G-aenial flo A3, 0,5 mm thickness; G3B: G-aenail flo A3, 0,8 mm thickness

Discussion

The fluorescence emission intensity of the flowable resins may influence the final behavior of the ceramic restoration in respect to fluorescence. The results obtained were statistically significant for the two thicknesses used. The thickness of the ceramic influences the final emission intensity of fluorescence. Samples with lower thickness have a higher emission of fluorescence. The thicker the ceramic, the more visible the substrate and, therefore, in the samples of 0.5 mm, the optical behavior of the flowable resin used as cement was more visible.

The use of flowable resins due to their low viscosity has become a valuable clinical use in the adhesion of very thin veneers [7] because they have high particle loading, increasing the color stability.

Conclusions

We concluded that different cements have different fluorescence emissions and that different ceramic thicknesses influence the final restoration behavior. Samples with a lower thickness have a higher emission of fluorescence.

Clinical Implications

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

References

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