Correlation between citotoxicity of self-etching resin cements and degree of conversion on fibroblasts

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Introduction: There are a great variety of materials for cementing indirect restorations. Due to improved physic-chemical properties compared to conventional cements. Recently self-etching resin cements dual polymerization was developed. These materials have emerged in order to simplify the surgical technique by eliminating the operative steps of etching and application of adhesive system. However, these cements are dual polymerization and thus depend on light for proper curing. As the indirect restorations are limited to the transmission of light, these cements may not achieve an appropriate degree of conversion. Mechanically, the incomplete polymerization of these cements results in lower adhesion, inadequate conversion of monomers into polymers have significant influence on pulpal response of teeth to these materials. The aim of the present study was evaluate the cytotoxicity of self-etch resin cements with or without photo-polymerization and correlate with degree of conversion.

Methods: FTIR spectra of cement samples were recorded in a Perkin Elmer spectrometer model Spectrum GX (Perkin Elmer, Boston, MA, USA) at 4000 – 400cm-1 in KBr pellets at a resolution of 4cm-1 using 32 scans per sample. For the assessment of the chemical activation mode in the %DC (n=6). The method used for the assessment of the %DC was the micro-attenuated total reflectance Fourier transform infrared spectrometry (micro-ATR FTIR). The experimental groups were: cement Rely-X Unicem without curing represents (G1), with photopolymerization (G2); without curing the Set (G3), with photopolymerization (G4), photopolymerization without Bifix SE (G5) and photopolymerization (G6). The fibroblasts represent the negative control (G7).

Cell Culture: The mouse fibroblast cell line L929 (ATCC, Rockville, MD, CCL-1 NCTC clone 929), were cultured in MEM (modified eagle's medium) medium (LGC, São Paulo, SP, BRA) with 4.5 g/l glucose, 2 mM L-glutamine 2.2 M sodium pyruvate, 10 mM HEPES (N-2-hydroxyethylpiperazine, N-2-ethanesulfonic acid), and 2.0 g/L sodium bicarbonate, 100 U/ml anfotericin–gentamicin containing 10% fetal bovine serum (Sigma).

Measurement: Cell viability was evaluated through mitochondrial activity was determined using the 3-(4,5-dimethylthiazol-2-yl)-diphenyltetrazolium bromide (MTT) microculture tetrazolium assay (Invitrogen, São Paulo/SP). The absorbance of each well was measured at 570 nm for MTT. *Statistical Analysis:* For this experimental study, each combination of assay mean optical density values were evaluated by one-way analysis of variance (ANOVA). Comparisons between groups were performed by a Tukey test.

Results: For both resin cements tested, the cell viability and increase of conversion rates are presented in Figure 1. The results showed that the cytotoxicity of the cements is directly related to the degree of conversion. There was significant difference between the same groups, with or without polymerization, and between the different groups ($p < 0.01$).

Table 1. Conversion degree after 20 seconds of polymerization

Group	Cement/polimerization	Degree of conversion Improved
G1	Rely-X Unicem/ without polymerization	12.5%
G2	Rely-X Unicem/with polymerization	12.5%
G3	Set/without polymerization	9.42%
G4	Set/with polymerization	9.42%
G5	BifixSE/without polymerization	16.6%
G6	BifixSE/with polymerization	16.6%

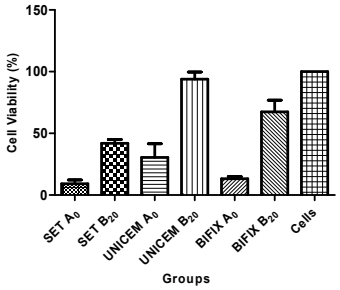

Fig.1. Fibroblasts survival after exposure to dental cements.

The three groups tested were significantly more cytotoxic than the same materials after 20 seconds of polymerization ($p < 0.01$). However, Set and BifixSE show to be severely cytotoxic, and was significantly more cytotoxic than Rely-X UNICEM that show moderately cytotoxic without polymerization. In relation of the groups with polymerization, Rely-X Unicem show >90% cell viability without significantly difference from positive control, whereas may be considered non-citotoxic in conditions of this experiment. The groups G6 and G4 show slightly cytotoxic and moderately cytotoxic, respectively. The best results for cell viability recorded by each resin cement in relation to groups with or without photopolymerization happened due to increase of degree of conversion of 12.2% for G1 to G2, 9.4% for G3 to G4 and 16.6% for G5 and G6 by the 20 seconds of photopolymerization.

Conclusions: These results indicated that during clinical application of resin cements, differential toxic effects on the pulp cells and the curing mode should be considered during selection of suitable resin cements for restoration.

References:

(Kong N. Dental Materials. 2009; 25: 1371-75.); (Demirci M. Dental Materials. 2008; 24:362-71).