and 6 min. Microstructural characterization was made using a high-resolution scanning electron microscope (TESCAN Mira 3) (SEM) operated at 25 kV. Composition was analyzed by X-ray diffraction (Bruker D8 Advance) (XRD). Relative density (r.d.) of the sintered samples was measured using the Archimedes method.

Results: The densified samples resulted to be white coloured, with r.d. > 98%. XRD showed compositions of 100% tetragonal phase, with grain sizes around 25 nm. The SEM micrographs showed the remarkable nanostructure and the absence of residual porosity. Uniform rounded shaped nanograins with sizes ranging between 20 and 30 nm were observed, confirming XRD analysis.

Conclusions: The production of fully dense 3Y-TZP samples was achieved through application of HP-FAST technique; starting from nanopowders (prepared by a simple hydrothermal method), high r.d. (>98%) samples could be obtained at temperatures as low as 900 °C and for sintering times of only 5 min at 700 MPa. As a consequence of the mild sintering conditions, a limited grain growth was observed, with final grain sizes around 25 nm and a remarkable fine microstructure.

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Mechanical and fracture behavior of metal-ceramic and all-ceram full crowns

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Objectives: The present study aimed to compare the mechanical and fracture behavior of premolar teeth restored with metal-ceramic and In-Ceram ALUMINA® full crowns.

Materials and methods: Twenty intact teeth were selected to be prepared to receive ten metal-ceramic and ten In-Ceram ALUMINA® full crowns. Full crowns were subjected to monotonic loading at EMIC testing machine at a crosshead speed of 0.5 mm/min until fracture. Each type of full crowns was divided into two groups of five specimens. In the first group loads were applied in both cusps at the same time, simulating a physiologic loading and in the second group, the load was applied in the palatal cusp, simulating an interference resulting from a mandibular lateral movement. The results of fracture resistance were subjected to analysis of variance (ANOVA). The level of significance in all tests was 5% ($p \leq 0.05$). The fractured crowns were subjected to fractographic analysis.

Results: Metal-ceramic crowns presented higher fracture resistance for both physiologic and palatal loads application (an average of 2438 N and 1199 N, respectively), when compared to In-Ceram ALUMINA® crowns (an average of 954 N and 782 N, respectively). In In-Ceram ALUMINA® crowns were observed a local compression in the veneering ceramic below the indenter (contact zone), inducing the formation of "Hertzian cracks", leading to a catastrophic fracture, since the fracture runs across the crown, dividing it into parts. In the metal-ceramic crowns, adhesive or cohesive fractures occur only in the veneering ceramic, and the metal infra-structure and teeth remain intact.

Conclusions: Metal-ceramic crowns presented higher fracture resistance for both physiologic and palatal loads application when compared to In-Ceram ALUMINA® crowns. Although both systems were indicated for teeth rehabilitation, special care must be taken in patients with lateral group disocclusion, when lateral loads are present in the tooth or when patients have parafunctional activities.

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Monomer conversion of resin cement under different curing conditions

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Objectives: The aim of this study was to evaluate the influence of different curing conditions on the degree of conversion (DC) of RelyX Unicem 2 self-adhesive dual-cured resin cement using infrared spectroscopy.

Materials and methods: The self-adhesive dual-cured resin cement (RelyX Unicem 2, 3M ESPE) was applied to the surface of a horizontal attenuated-total-reflectance unit, and polymerized using Elipar S10 curing unit (3M ESPE). The material was evaluated under different conditions: self-cure, direct light exposure through glass slide or through indirect restorative materials [pre-cured resin (Lava Ultimate, 3M ESPE), shade A2 or ceramic (Vita Blocks Mark II, Vita), shade 2M2C] with different thickness (0.5, 1.0, 1.5 or 2.0 mm). Infrared spectra of the uncured cementing systems were recorded immediately after application to the ATR, after the system was light-cured or left to self-cure, and spectra were obtained 5 and 10 min later. DC was calculated using standard techniques of observing changes in aliphatic-to-aromatic peak ratios pre- and post-curing. Data ($n = 5$) were analyzed by two-way repeated measures ANOVA, Dunnett and Tukey's test ($p = 0.05$).

Results: The DC obtained through indirect materials (composite and ceramic) had no significant differences for any thickness tested. The self- and light-curing mode showed no significant differences between them. The direct light exposure through glass slide or through indirect restorations resulted in higher DC after 10 min than after baseline time and 5 min. The thickness of indirect restorations did not influence the DC of resin cement after 5 and 10 min post-curing.

Conclusions: The type of indirect restoration and the curing mode did not affect the DC of RelyX Unicem 2 resin cement. The highest DC was observed after 10 min, while the thickness of composite and ceramic indirect restorations did not decrease the DC after only 5 and 10 min post-curing.

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