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Aim: Hybrid layer mechanical properties could predict clinical performance of composite resin restorations overtime. The aim of the study was to evaluate the mechanical properties of coronal hybrid layer, obtained with several adhesive systems, before and after artificial aging.

Methods: 48 molars, extracted for periodontal reasons, were selected for this in vitro study. Enamel surface was removed in order to expose flat sound coronal dentin. A standardized smear layer was created with a 600 grit paper. Then, samples were divided in four groups according to the adhesive system employed: Optibond FL (Kerr, USA, Group 1); SE Bond 2 (Kuraray, Japan, Group 2); Adhese Universal in etch&rinse mode (Ivoclar, Luxembourg), Group 3); Adhese Universal in self-etch mode (Ivoclar, Luxembourg, Group 4). Each group was subsequently divided in two subgroups according to the dentin pretreatment employed: subgroup A: 0,12% chlorhexidine digluconate application for 30 seconds; subgroup B: no pretreatment. Each adhesive was applied on dentin according to manufacturer's instructions. After light curing, which was performed with a LED lamp for 20 seconds, the restoration was completed with nano-hybrid resin composite (Clearfil ES-2; Kuraray), which was placed in 2mm horizontal layers and light-cured individually for 20 s. After 24h, samples were cutted in 1mm thick slices perpendicular to the hybrid layer with a diamond saw under water cooling. Each slices was flattened up to 2400grit paper. Then, samples were tested with a Nanoindenter XP (MTS/Agilent, USA), equipped with a diamond Berkovich indenter and characterized by a theoretical force resolution of 50 nN and a theoretical displacement resolution lower than 0.01 nm. The loading-displacement (P-h) curves have been analyzed by using the Oliver-Pharr method in way to obtain the Elastic Modulus and the Hardness. Samples were finally stored in artificial saliva and the above mentioned evaluations were repeated after 24h, 7 and 15 days of storage. Statistical analyses was performed with ANOVA test and significance was set for $p < 0.05$.

Results: Hybrid layer hardness and young modulus were significantly correlated to the adhesive system employed ($p = 0.0001$), but not to the dentin pretreatment (0.0765). Indentation map showed the mechanical properties progression along the coronal hybrid layer. The universal adhesive system shows a significantly lower hardness than the other tested adhesives.

Conclusion: The above mentioned results should be reconsidered after samples artificial aging to understand a correlation between hybrid layer mechanical properties and its degradation overtime. However, the etch-and-rinse protocol showed a higher hardness and more homogenous young modulus due to a uniform and deeper dentin demineralization and infiltration.

Influence of restorative technique on the fracture resistance of molar teeth restored with composite overlays

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Aim: To evaluate the resistance to load of maxillary molars restored with composite overlays manufactured with three different techniques, namely the traditional indirect technique, a chairside semi-direct technique, and a CAD/CAM technique.

Methods: Sample size was calculated considering the results obtained in preliminary experimental studies ($\alpha = 0.05$; $\beta = 0.20$; $\delta = 500.0$; $\sigma = 300.0$). Eighteen sound maxillary molars of comparable size were selected from a pool of freshly extracted teeth and received a standardized preparation for a full-coverage overlay with two proximal boxes. The prepared teeth were randomly divided into three experimental groups of 8 elements each: traditional indirect technique with polyvinyl siloxane impression and stratification on a stone model; chairside semi-direct technique with alginate impression and stratification on a silicon model; CAD/CAM technique with digital impression and production with the Cerec 3 system. All tested materials were resin-based composites of the same brand (Voco). For the CAD/CAM production process, a custom-designed phantom model was used. The cementation protocol was the same for all groups and involved the use of sandblasting, self-etch adhesive procedures with selective enamel etching, and dual-cure resin cement. All the restored teeth underwent thermomechanical aging (1,250,000 cycles, 1Hz, 5-55°C); afterwards, they were axially loaded to fracture with a universal testing machine with a round-head stainless steel stylus. The type of fracture was registered. The groups were compared in terms of maximum load to fracture with a one-way analysis of variance and Scheffè post-hoc test ($p < 0.05$).

Results: No defects were appreciable on the occlusal surface of the specimens after the thermomechanical aging. In all the tested groups, the mean registered values of maximum load exceeded the threshold of the masticatory forces (≈ 800 N). The CAD/CAM technique

exhibited the greatest resistance values (2136.2 ± 295.1 N). The traditional indirect technique (1599.8 ± 252.8 N) and the chairside semi-direct technique obtained significantly lower resistance values (1472.9 ± 574.8 N), which were statistically similar. The most prevalent type of failure was fracture with fragment detachment below the cemento-enamel junction.

Conclusion: Under the conditions of the present study, all the tested restorative techniques showed satisfactory performance in terms of resistance to load. In the comparison among groups, composite CAD/CAM overlay.

Effect of a finishing and polishing system on hardness and gloss surface of four resin composites

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Aim: The purpose of this study is to evaluate the behavior of the gloss and morphology surface and hardness of four resin-based composites before and after using the same finishing and polishing system.

Methods: Four resin-composite material was investigated: Harmonize (Kerr), Gradia Direct (GC corporation), Estelite Σ Quick (Tokuyama Dental), TPH Spectra (Dentsply). Twenty discs of composite were prepared using homemade Teflon molds. A glass on bottom and a Mylar strip on top were used to exclude the oxygen inhibition during curing. Then, they were polymerized for 20 seconds both the top and the bottom. All the different composites specimens were divided into 3 groups ($n=5$): Control Group (with Mylar strip), Unpolished Group (with microbrush and spatula application) and Polished Group that consist in Sof-Lex discs (3M, ESPE), Spiral Wheels beige and then Spiral Wheels purple (3M, ESPE) with diamond paste (Enamel Shine C, Micerium). For evaluate resin-based composite hardness was used a Leitz micro-hardness tester. Gloss was determined by a glossmeter, calibrated with a reference value of 95 gloss units (GU). All samples were also examined by Scanning Electron Microscopy (SEM) to examine the morphology before and after finishing and polishing.

Results: The mean hardness and gloss values showed statistically different results among the different resin composites. For the hardness, in Control Group, Harmonize showed the highest hardness ($64,3 \pm 2$), Gradia Direct showed the lowest one (31 ± 2). In Unpolished Group, Harmonize showed the highest hardness (66 ± 4). Gradia Direct showed the lowest one ($35,8 \pm 3$). In Polished Group, Harmonize ($68 \pm$

3) and Estelite (67 ± 1) showed the highest hardness. Gradia Direct showed the lowest one ($37,4 \pm 3$). Estelite and TPH Spectra showed an improvement of hardness from unpolished to polished. For the gloss surface, in Control Group, TPH Spectra showed the highest gloss values (103 ± 3), while in Unpolished Group Estelite showed the lowest (4 ± 1). In Polished Group, TPH Spectra showed the highest gloss values (41 ± 9). SEM micrographs showed that smooth flat surfaces especially in the finished glossy samples. ANOVA test and post hoc t-test were used for statistical evaluations ($p < 0.05$).

Conclusion: The hardness and gloss surface are material dependent. The hardness surface improves with the polishing. It can be also recommended to use Estelite, Harmonize and TPH Spectra on the occlusal surface. The highest gloss surface is obtained when the resin composite polymerizes against a Mylar matrix without finishing and polishing. However, this study demonstrates that acceptable gloss results are obtained using systems combined with a diamond paste. Many manufacturers offer different finishing and polishing systems, despite no consensus has been reached on the method providing the smoothest and highest gloss surface. The suggested reliable and simple protocols can be advantageous for clinicians in order to obtain a considerably worth aesthetic result.

Effect of bulk fill technique and incremental placement technique on cuspal deformation in restored premolars

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Aim: In direct restorations composite materials shrinks during the polymerization phase. Shrinkage leads to stress at the interface, it causes restoration's detachment with subsequent possibility of secondary caries and post-operative sensitivity of the dental element. A conscious and reasoned use of restoration materials available on the dental market can be useful in trying to reduce this stress. The aim of the work is to compare the cuspal strain in mesio occlusal distal restorations made with bulk-fill technique respect to conventional incremental technique.

Methods: 10 extracted premolars were collected and stored in 0.5% thymol at 5 °C. They were stabilized in metal cylinders and divided into two groups ($n = 5$).