

## Euro Dental 2018: Micro-leakage of indirect nano-hybrid resin composite inlay restorations fabricated using flexible die versus stone die after 24 hours and 3 months: An in vitro study

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**Objectives:** The aim of this study was to compare the micro-leakage of indirect nano-hybrid resin composite inlay restorations fabricated using flexible die versus stone die.

**Introduction:** Current trends in esthetic dentistry necessitate the use of tooth-colored materials that mimic the natural teeth appearance. These materials meet the patient's desires and allow with the postulation of the contemporary dentistry. Our concerns with esthetics are increasing and so dentists are shifting their field of work from the metallic restorations to the tooth-colored ones. Resin composite materials are one of the most commonly used materials nowadays. Although efforts are done every now and then to overcome the shortcomings of these materials, still resin composite tends to fail because of the internal deficiencies in the material itself.

**Methods:** A total number of 44 sound non-cavitated freshly extracted upper human premolar teeth were selected for this study. Teeth were randomly divided into two main groups according to the die material. Each group was subdivided according to the storage period, after 24 hours and after 3 months with 11 teeth in each. Two Way ANOVA used to compare between tested die materials and the time intervals for mean microleakage (mm) and dimensional changes (%). One-Way ANOVA used to for interaction between variables followed by Tukey's post hoc test for pairwise comparison.

**Cavity preparation:** A specimen was prepared according to the principles of indirect composite restoration preparation. Specimens were centralized and fixed in the CNC machine whereby the cavity walls diverged 8-10° over mesial and distal surfaces were

established to form MOD cavity preparation with cavity depth about 4mm from the cavo-surface angle using CNC machine (Computer Numerical Control) milling machine at under water coolant.

**Impression taking:** A custom-made cylindrical wax mold of 30mm height was prepared for easy impression taking from

the prepared teeth. Alginate impression material was mixed and pored to fill the mold. The specimen was then immersed in the alginate upside down and kept for 4 minutes until complete setting of the material.

**Cementation of the prefabricated inlay:** After ensuring correct and complete sitting of the inlay, enamel margins were etched with 35%

phosphoric acid (Vocacid) for 20 seconds and then it was washed with water for 20 seconds and dried gently with a piece of sponge. Futura bond adhesive was then applied with micro brush and was rubbed for 20 seconds then cured for 20 seconds using the LED curing unit.

**Micro leakage assessment:** Specimens were sectioned buccolingually through the center of the restoration using diamond

disc. The dye penetration along the cavity wall was assessed with USB Digital microscope

**Statistical Analysis:** Data statistically described in terms of mean and standard deviation. Data explored for normality

using Kolmogorov Smirnov test. Two Way ANOVA used to compare between tested die materials and the time intervals for mean microleakage (mm) and dimensional changes (%).

**Results:** results which showed that die materials had a significant effect on the micro-leakage values in mm at P-value equal to 0.007. On the other hand time intervals variables had an insignificant effect on the micro-leakage values at P-value equal to 0.189.

**Conclusion:** The clinical performance of resin composite has been significantly improved over the past decade to provide proper strength, better depth of cure and less polymerization shrinkage. Nano-hybrid resin composite has optimal esthetic properties. Beside this, its micro and macro-mechanical properties have been enhanced to be comparable or even higher than micro-hybrid composite. One reason of such behavior is the chemical nature of the nano-fillers, being predominantly made of crystalline silica and zirconia and thus harder than amorphous glasses used in micro-hybrid composite. Also, it could be due to the change occurred in the organic matrix between particles as a result of decreased filler size and decreased inter-particle distance. (Lllie and Hichel 2013) Yet, drawbacks such as technique sensitivity, polymerization shrinkage and prolonged chair time have been an enough motive for further improvement in its placement technique. Hence, some improvements have been introduced in its chemical composition enabling more applicability. Manufacturers claimed that they can be used in both direct and indirect restoration. Resin Composite

is characterized by having mechanical properties similar to dentin. Their elastic modulus, ultimate

compressive strength, and hardness depend on the volume of filler in the restorative material. Resin

Composite used for indirect and direct restorations exhibit similar flexural strength, flexural modulus,

and hardness (Cetin and Unlu, 2009). Flexible die as well as stone die were used. Flexible die technique includes taking silicone impression and pouring it with the same silicone material to get the flexible die. Chemical similarity between the impression and die material mandates using a separating medium in between which may contaminate the inlay fitting surface. Grandioso inlay system dictates taking alginate impression and pouring it with silicone material without applying separating medium. Such technique may decrease the risk for compromised bond due to contamination. The impression were made by alginate according to the die silicon manufacturer's instructions, and flexible die was been chosen instead of stone die because it produced better surface detail reproduction than the control dies according to (Gerrow and Price 1998). These die materials have different degree of dimensional changes and subsequently have an influence on the micro leakage of the final restoration. Thus evaluation of the die dimensional changes and the micro leakage of the produced indirect restoration were done. Dimensional change is not a challenging problem for the flexible die. The dimensional stability of the stone and flexible die material was not influenced by the storage time.