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Deposition of Hydroxyapatite Nano-Particle on Zirconia to Improve its Bonding

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Purpose: Although Zirconia has many advantages in the restorative dentistry, some concerns exist about its bonding strength to different dental substrates. On the other hand, Hydroxyapatite is an excellent biocompatible material with good bonding ability. In this study, it was hypothesized that combining the mechanical properties of Zirconia with bonding features of Hydroxyapatite would improve bond strength of Zirconia to different dental substrates.

Material and Method: Forty five Zirconia blocks were randomly divided into the 3 groups; Hydroxyapatite deposition, sandblasting and control. In the first group, the surface of zirconia blocks was thermal coated by Hydroxyapatite nano-particle. In the second group, the zirconia blocks were sandblasted with Al₂O₃ 50 µ particles. In the control group, no surface treatment was done. The blocks were bonded to cement and following load application, the micro-shear bond strength of Zirconia to the resin cement was measured. The bond strength values were analyzed by Kruskal-Wallis test in 3 groups and paired comparisons were made by Mann-Whitney U test. The failure patterns of the specimens were studied by a stereomicroscope and a scanning electron microscope and then analyzed by the chi-square test (significance level = 0.05).

Result: Deposition of hydroxyapatite on the zirconia surface significantly improved its bond strength to the resin cement in comparison with the control specimens ($p < 0.0001$). Also, the bond strength was similar to the sandblasted group ($p = 0.34$). The sandblasted and control group only showed adhesive failure, but the hydroxyapatite coated group had mixed failures, indicating the better quality of bonding ($p < 0.0001$).

Conclusion: Hydroxyapatite coating on the Zirconia surface improved the bond strength quality and values.

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