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# EVALUATION THE EFFECT OF THE ADDITION OF ZIRCONIUM OXIDE AND TITANIUM DIOXIDE NANOPARTICLES ON SHEAR BOND STRENGTHS OF ORTHODONTIC ADHESIVE: IN-VITRO STUDY

# Abstract:

**Objectives:** the study aims to assess the shear bond strength of modified- 3M orthodontic adhesive Transbond™ XT with different concentrations of Titanium Dioxide and zirconium oxide nanoparticles.
**Materials and Methods:** In a retrospective cross-sectional study a hundred sound-extracted human upper premolars were collected. 3M orthodontic adhesive Transbond™ XT was modified by (0,02%, 0.04%, and 0.06% Zirconium Oxide), and (0,02%, 0.04%, and 0.06% Titanium Dioxide) nanoparticles, and (0,02%, 0.04%, and 0.06% Zirconium Oxide and Titanium Dioxide). dentaurum discovery pearl ceramic bracket were bonded to buccal enamel surfaces of the samples of control and nine modified adhesive groups. At 24 h after bonding, shear bond strength was measured. Adhesive remnant index was scored under (10X) magnification power of stereomicroscope after de-bonding. The chemical characteristics of orthodontic adhesive material were explored before and after mixing with Titanium Dioxide and zirconium oxide nanoparticles by using FTIR.
**Results:** (Zirconium Oxide nanoparticles) group and combination ( Zirconium Oxide and Titanium Dioxide nanoparticles) had a higher shear bond strength mean value than the control group, 0.06% combination (Zirconium Oxide and Titanium Dioxide nanoparticles) group had the highest mean value. About adhesive remnant index, no significant differences were found among the studying groups.
**Conclusions:** the addition of 0.06% combination (Zirconium Oxide and Titanium Dioxide nanoparticles) had the best performance and improved shear bond strength of 3M orthodontic adhesive Transbond™ XT

results in a polymer nanocomposite which, compared to resins filled with micro-scale particles, possess enhanced physical and mechanical characteristics; furthermore, utilizing several Nano fillers instead of just one allows for a higher performing composite than would be possible with adding just one nano filler [7].
The application of nanotechnology has resulted in significant advancements in the area of orthodontics. Increasing the shear bonding strength of orthodontic materials, for example, just requires the addition of nanoparticles to the materials that are traditionally used [8]. This research's primary objective was to learn how nanoparticles incorporation ($ZrO_2$ and/or $TiO_2$) into orthodontic adhesive would affect its physical characteristics