Shear bond strength and adhesive remnant index of orthodontic brackets bonded to enamel using adhesive systems mixed with TiO_2 nanoparticles

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Introduction: It is recently suggested that titanium dioxide (TiO_2) nanoparticles can be added to bracket luting agents in order to reduce bacterial activity and protect the enamel. However, it is not known if this addition can affect the shear bond strength (SBS) below clinically acceptable levels. Therefore, this study examined this matter within a comprehensive setup.

Methods: This in vitro experimental study was conducted on 120 extracted human premolars randomly divided into four groups (n=30): in groups 1 and 2, Transbond XT light-cured composite with or without TiO_2 was applied on bracket base; in groups 3 and 4, Resilience light-cured composite with or without TiO_2 was used. Brackets were bonded to teeth. Specimens in each group (n=30) were divided into three subgroups of 10 each; then incubated at 37°C for one day, one month, or three months. The SBS and adhesive remnant index (ARI) were calculated and compared statistically within groups.

Results: The SBS was not significantly different at one day, one month or three months ($p>0.05$) but composites without TiO_2 had a significantly higher mean SBS than composites containing TiO_2 ($p<0.001$). The SBS of Transbond XT was significantly higher than that of Resilience ($p<0.001$). No significant differences were noted in ARI scores based on the type of composite or addition of TiO_2 ($p>0.05$).

Conclusions: Addition of TiO_2 nanoparticles to Transbond XT decreased its SBS to the level of SBS of Resilience without TiO_2; thus, TiO_2 nanoparticles may be added to Transbond XT composite for use in the clinical setting.

Keywords: Titanium dioxide. Nanoparticles. Orthodontic brackets. Shear bond strength.

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