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Assessment of the Effect of Adhesion Boosters on Shear Bond Strength of Orthodontic Brackets on Bleached Teeth

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Abstract--Background: The bleaching procedure results in damage to the outer enamel layer by forming porosities, which leads to demineralization and modification in the calcium–phosphate ratio. The present study was conducted to assess the effect of adhesion boosters on shear bond strength (SBS) of orthodontic brackets on bleached teeth. Materials & Methods: 60 maxillary premolars teeth were randomly divided equally into 2 groups. Group I were bleached teeth and group II had non-bleached teeth. Each group was further divided equally into 3 subgroups (n = 10) depending on the type of adhesive booster used (Enhance LC, All-bond 2, and no adhesive booster [control]). Maxillary premolars brackets were bonded.

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Debonding was done with a universal testing machine, and the SBS was recorded. Results: The mean shear bond strength (MPa) in Group IA was 10.5, in IB was 13.2, in IA was 10.5, in IC was 14.3, in IB was 13.2, in IC was 14.8, in IIA was 9.8, in IIB was 11.2, in IIA was 9.8, in IIC was 12.3, in IIB was 11.2 and in IIC was 12.8. The difference was significant ($P < 0.05$). Conclusion: Adhesive boosters increased the shear bond strength of both bleached and non-bleached teeth significantly.

Keywords---adhesive, bleached teeth, shear bond strength, strength orthodontic.

Introduction

With increased awareness of cosmetic dentistry, teeth bleaching has become a popularized patient requisite procedure to enhance the smile (Ray, 1983). However, the bleaching procedure results in damage to the outer enamel layer by forming porosities, which leads to demineralization and modification in the calcium-phosphate ratio. Studies suggest a significant decrease in brackets' survival rate bonded to the bleached tooth compared to the non-bleached tooth. Hence, a bleached tooth may require additional bond strength when compared to non-bleached teeth (Bowen & Marjenhoff, 1992).

The words 'adhesion promoters' were first used to designate molecules that adhered chemically to dental structures. One of the first molecules tested was N-phenylglycineglycidyl methacrylate, which was proposed by Bowen in 1965. The first dentin adhesive was created with this molecule, but commercial products showed poor clinical results. Adhesion to the dentin was unsuccessful until the introduction of hydrophilic resins, resins that promote adhesion to dentin (Swift et al., 1995). Adhesive promoters were previously described as a surface-active comonomer that attempts to build chemical adhesion of plastic to the tooth. layout, later were found to enhance the bond strength of bleached teeth (Ekhlassi et al., 2011). However, early commercial applications with N-phenyl glycineglycidyl methacrylate (NPG-GMA) products had yielded poor clinical results. Various adhesive boosters available include Enhance LC, All-bond 2, and Orthosolo (Fitzpatrick & Way, 1977). The present study was conducted to assess the effect of adhesion boosters on shear bond strength (SBS) of orthodontic brackets on bleached teeth.

Materials & Methods

The present study comprised of 60 maxillary premolars teeth and pre-adjusted edgewise maxillary premolar stainless steel brackets. The extracted maxillary premolars were non-carious. Teeth samples were cleaned and stored in 0.1% wt/vol thymol solution to prevent bacterial contamination until bleaching and bonding. The sample was randomly divided equally into 2 groups. Group I were bleached teeth and group II had non-bleached teeth. Each group was further divided equally into 3 subgroups ($n = 10$) depending on the type of adhesive booster used (Enhance LC, All-bond 2, and no adhesive booster [control]).

Maxillary premolars brackets were bonded. Debonding was done with a universal testing machine, and the SBS was recorded. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table 1
Comparison of shear bond strength

Groups	Subgroup	Mean (Mpa)	P value
Group I (non-bleached teeth)	IA	10.5	0.01
	IB	13.2	
	IA	10.5	0.02
	IC	14.3	
	IB	13.2	0.21
	IC	14.8	
Group II (bleached teeth)	IIA	9.8	0.04
	IIB	11.2	
	IIA	9.8	0.02
	IIC	12.3	
	IIB	11.2	0.25
	IIC	12.8	

Table I, Figure 1 shows that mean shear bond strength (MPa) in Group IA was 10.5, in IB was 13.2, in IA was 10.5, in IC was 14.3, in IB was 13.2, in IC was 14.8, in IIA was 9.8, in IIB was 11.2, in IIA was 9.8, in IIC was 12.3, in IIB was 11.2 and in IIC was 12.8. The difference was significant (P< 0.05).

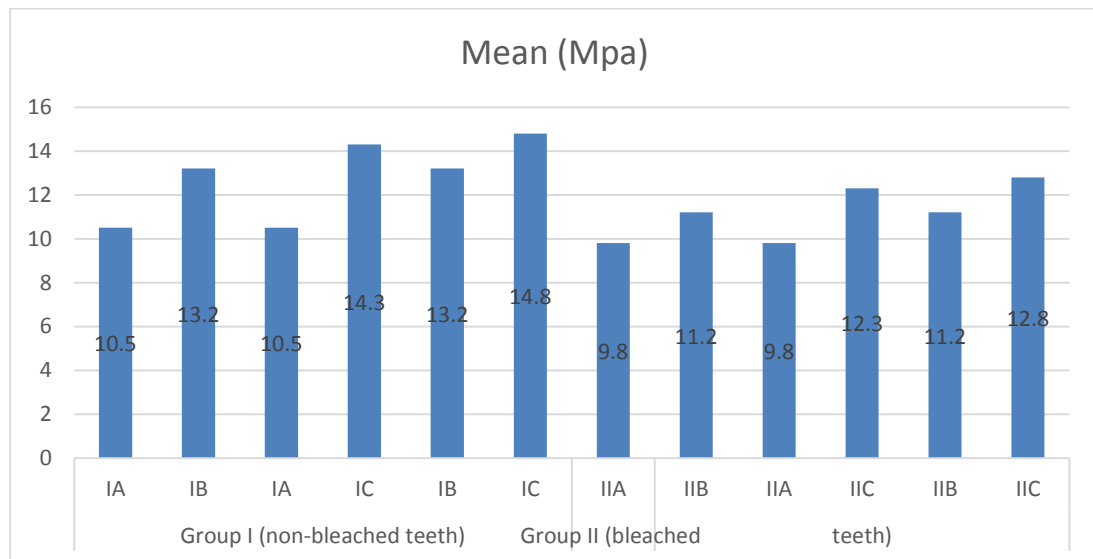


Figure 1. Comparison of shear bond strength

Discussion

Adhesion promoters are multifunctional molecules which adsorb on to and alter the enamel surface so that the interaction with the restorative resin by a chemical or physical process is facilitated (Gungor et al., 2013; Patusco et al., 2009). An ideal adhesion promoter is described as one that is adsorbed on to the enamel surface as a monomolecular layer which will prevent contamination of the solid by organic substances (Titley et al., 1992). The portion of molecule that is not adsorbed should leave a surface which can be more easily wetted by the restorative resin and form a hydrophobic film to avoid water accumulation which could prevent efficient wetting by an uncured liquid restorative (Stokes et al., 1992). The present study was conducted to assess the effect of adhesion boosters on shear bond strength (SBS) of orthodontic brackets on bleached teeth.

In present study, mean shear bond strength (MPa) in Group IA was 10.5, in IB was 13.2, in IA was 10.5, in IC was 14.3, in IB was 13.2, in IC was 14.8, in IIA was 9.8, in IIB was 11.2, in IIA was 9.8, in IIC was 12.3, in IIB was 11.2 and in IIC was 12.8. Rangayanakulu et al. (2021), evaluated and compared the effect of adhesion boosters on shear bond strength (SBS) of orthodontic brackets on bleached teeth. A sample of 90 extracted maxillary premolars was equally divided into 2 groups of bleached and non-bleached teeth. Twenty-two percent carbamide peroxide gel was used as an agent for bleaching. Each group was further divided equally into 3 subgroups depending on the type of adhesive booster used (Enhance LC, All-bond 2, and no adhesive booster [control]) and maxillary premolars brackets were bonded. Debonding was done with a universal testing machine, and the SBS was recorded. The SBS of non-bleached teeth was highest for All-bond 2 (14.78 ± 2.47 MPa) followed by Enhance LC (13.15 ± 3.49 MPa) and control (10.30 ± 1.06 MPa). The SBS of bleached teeth was highest for All bond 2 (12.23 ± 1.41 MPa) followed by Enhance LC (11.76 ± 1.71 MPa) and control (9.63 ± 1.06 MPa). All subgroups showed a significant difference in SBS on bleached and non-bleached teeth. The SBS showed a significant difference between the bleached and non-bleached teeth in All-bond 2 group.

Hogan et al. (2011), determined the effect of 3 adhesion promoters: Ortho Solo™ (Ormco), ALL-BOND 2® (Bisco), and Enhance L.C. (Reliance) on the shear bond strength of new and recycled orthodontic brackets and the amount of remnant adhesive on the teeth after debonding and to verify whether Enhance L.C. is material specific as stated by the manufacturer. This study was carried out on 120 premolar teeth which were bonded to 0.018 Roth premolar brackets. These teeth were divided into 6 groups of 20 with 2 subgroups—new group and recycled group. Brackets were bonded according to manufacturer's instructions: 1) Transbond™ XT 2) Transbond™ XT + ALL-BOND 2® 3) Transbond™ XT + Ortho Solo™ 4) Transbond™ XT + Enhance L.C. 5) Light Bond™ 6) Light Bond™ + Enhance L.C. Bond strength was tested on a universal testing machine and remnant adhesive on the tooth surface was determined. There was no significant difference between the groups with respect to the median load. Higher mean load was recorded in Group VIa (Light Bond™ + Enhance L.C.) and least in Group Ib (recycled with Transbond™ XT). Chi-square test showed no significant association between the ARI scores and the different groups.

Vijayakumar et al. (2010), evaluated the effects of three adhesion boosters--All-Bond 2, Enhance LC, and Ortho Solo--on the shear bond strength of new and rebonded (previously debonded) brackets. 100 new and 100 sandblasted debonded brackets were bonded to 200 extracted human premolars and divided into eight groups. The new brackets/Ortho Solo group yielded the highest bond strength, followed by the new brackets/All-Bond 2 and the new brackets/Enhance LC groups. During rebonding, Ortho Solo improved the bond strength significantly; however, All-Bond 2 and Enhance LC did not. Bond strength is significantly improved when new brackets are bonded with an adhesion booster; (2) without any adhesion booster, sandblasted rebonded brackets yield a significantly lower bond strength than new brackets; (3) Enhance LC failed to improve the bond strength of rebonded brackets; (4) Ortho Solo increased the bond strength of rebonded brackets significantly; and (5) brackets rebonded with Ortho Solo yielded comparable bond strength as new brackets without any adhesion booster.

Conclusion

Authors found that adhesive boosters increased the shear bond strength of both bleached and non-bleached teeth significantly.

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