

Original Research

Assessment of the effect of primer precuring on the shear bond strength of orthodontic brackets

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ABSTRACT:

Background: In direct bonding of orthodontic brackets, current bonding systems involve etching the enamel surface, flowing an unfilled or lightly filled liquid resin into the etched surface, and then using a filled resin on the bracket base to form the final bond between the bracket and the tooth before self-curing or light curing the adhesive. The present study was conducted to assess the effect of primer precuring on the shear bond strength of orthodontic brackets. **Materials & Methods:** The present study comprised of 120 mandibular incisors. Teeth were divided randomly into 2 groups. Each group comprised of 60 teeth. In group I, transbond APC II and in group II, quick cure were used. Both the groups were further subdivided into those in which primer was not cured before bracket placement and those in which the primer was precured. The shear-peel bond strength was tested with a testing machine at 30 minutes and 24 hours. **Results:** The mean bond strength (MPa) in group I at 30 minutes and 24 hours, primer not cured before bracket placement was 17.65 and 19.02, primer cured before bracket placement was 17.89 and 19.11. In group II, at 30 minutes and 24 hours, primer not cured before bracket placement was 21.31 and 27.52, primer cured before bracket placement was 16.45 and 25.48 respectively. The difference found to be non-significant ($P > 0.05$). **Conclusion:** There was no advantage or disadvantage in bracket bond strength by precuring the primer before placing the bracket and filled component of the adhesive.

Key words: bracket, shear bond strength, primer

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INTRODUCTION

In direct bonding of orthodontic brackets, current bonding systems involve etching the enamel surface, flowing an unfilled or lightly filled liquid resin into the etched surface, and then using a filled resin on the bracket base to form the final bond between the bracket and the tooth before self-curing or light curing the adhesive.^{1,2} There are variations in the clinical techniques of orthodontic clinicians; some cure the unfilled resin as a separate step, and others cure both the filled and the unfilled resin in 1 step. The manufacturers' instructions, in general, do not advise either precuring the liquid resin or not.³ The demand for orthodontic treatment has been gradually increasing among the adult population. This

increase in the number of orthodontic patients presents new problems to the orthodontists. As many patients have restored teeth with various restorative materials, such as composite resin, amalgam, and porcelain, orthodontists are more likely to face the difficulty of bonding orthodontic attachments to these materials.⁴ Particularly in adolescent orthodontic patients, composite resin restorations are often present on the labial surfaces of maxillary incisors and occasionally on the buccal surfaces of posterior teeth.⁵ The frequency of composite resin restorations in posterior teeth has increased with the improvement in the properties of aesthetic filling materials. Previously, brackets were bonded to fresh composite in patients referred for orthodontic treatment whereas

composite restorations have been ageing for a long time in a humid oral environment.⁶ The present study was conducted to assess the effect of primer pre-curing on the shear bond strength of orthodontic brackets.

MATERIALS & METHODS

The present study comprised of 120 mandibular incisors. The study was approved from higher authorities.

Teeth were divided randomly into 2 groups. Each group comprised of 60 teeth. In group I, transbond APC II and in group II, quick cure were used to determine the efficacy of pre-curing the liquid resin primer phase of the systems to increase shear bond strength. Both the groups were further subdivided into those in which primer was not cured before bracket placement and those in which the primer was pre-cured. The shear-peel bond strength was tested with a testing machine at 30 minutes and 24 hours.

Results thus obtained were assessed statistically using chi-square test. P value less than 0.05 was considered significant.

RESULTS

Table I shows that group I had Transbond APC II and group II had Quick cure adhesive. Each group comprised of 60 teeth. Table II, graph I shows that mean bond strength (MPa) in group I at 30 minutes and 24 hours, primer not cured before bracket placement was 17.65 and 19.02, primer cured before bracket placement was 17.89 and 19.11. In group II, at 30 minutes and 24 hours, primer not cured before bracket placement was 21.31 and 27.52, primer cured before bracket placement was 16.45 and 25.48 respectively. The difference found to be non-significant (P> 0.05).

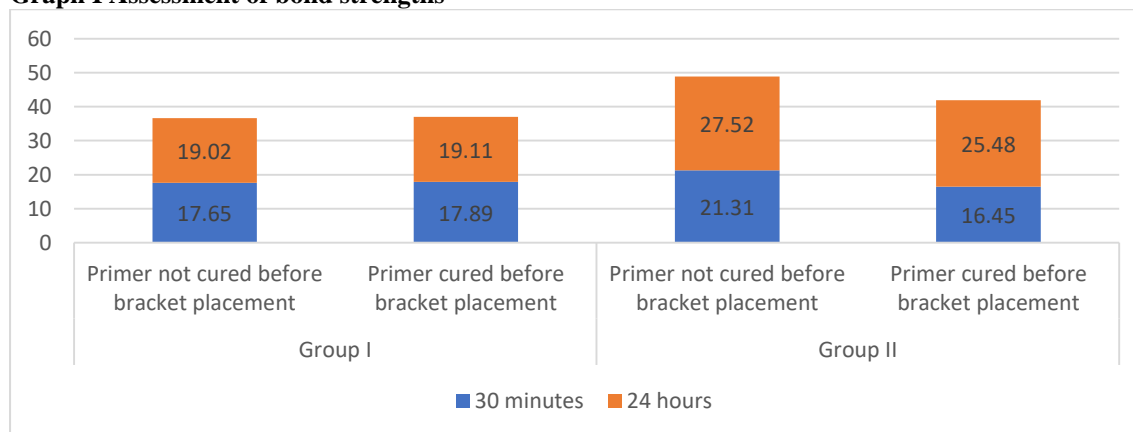
Table I Distribution of samples

Groups	Group I	Group II
Adhesive	Transbond APC II	Quick cure
Number of teeth	60	60

Table II Assessment of bond strengths

Groups	Variable	30 minutes	24 hours
Group I	Primer not cured before bracket placement	17.65	19.02
	Primer cured before bracket placement	17.89	19.11
Group II	Primer not cured before bracket placement	21.31	27.52
	Primer cured before bracket placement	16.45	25.48
P value		0.12	0.32

Graph I Assessment of bond strengths



DISCUSSION

When an orthodontic attachment is bonded to a composite restoration in the oral cavity, it is likely that the restoration has been ageing for a long time in a humid environment.⁷ This means that water saturation of composite resin has been reached and free radical activity has ended.⁸ Absorbed water causes softening of the matrix, microcrack formation, resin degradation, and debonding of the filler–matrix interfaces.⁹ A tendency for bond strength between new and old composite to decrease after ageing and storage of the old material in saliva has been reported.^{10,11} The present study was conducted to assess the effect of primer pre-curing on the shear bond strength of orthodontic brackets.

We found that group I had Transbond APC II and group II had Quick cure adhesive. Each group comprised of 60 teeth. Oesterle et al¹² in their study two adhesive systems, Transbond APC II (3M Unitek, Monrovia, Calif) and Quick Cure (Reliance Orthodontic Products, Itasca, Ill), were used to determine the efficacy of pre-curing the liquid resin primer phase of the systems to increase shear bond strength. There were no statistically significant differences between the bond strengths for either adhesive with the primer cured or uncured before bracket placement at either the 30-minute or 24-hour test times. When the ARI scores were examined statistically, there was a statistical difference between the cured and uncured primer groups with only the Transbond APC Adhesive. The Transbond groups in which the primer was not cured before bracket placement had more adhesive remaining on the tooth after testing. There was no significant difference between the ARI scores of the Quick Cure groups. Statistical testing between the Transbond and Quick Cure adhesives found a statistical difference at the 24-hour testing time but not at the 30-minute time, with Quick Cure significantly stronger than Transbond at 24 hours.

We observed that mean bond strength (MPa) in group I at 30 minutes and 24 hours, primer not cured before bracket placement was 17.65 and 19.02, primer cured before bracket placement was 17.89 and 19.11. In group II, at 30 minutes and 24 hours, primer not cured before bracket placement was 21.31 and 27.52, primer cured before bracket placement was 16.45 and 25.48 respectively. Bayram et al¹³ investigated the effects of surface conditioning protocols on the shear bond strength (SBS) of metal brackets to aged composite resin surfaces in vitro. Ninety composite resin discs, 6 mm in diameter and 2 mm in height, were prepared and treated with an ageing procedure. After ageing, the specimens were randomly assigned to one of the following groups: control with no surface treatment, 38 per cent phosphoric acid gel, 9.6 per cent hydrofluoric acid gel, airborne aluminium trioxide

particle abrasion, sodium bicarbonate particle abrasion, and diamond bur. The metal brackets were bonded to composite surfaces by means of an orthodontic adhesive (Transbond XT). All specimens were stored in water for 1 week at 37°C and then thermocycled (1000 cycles, 5–55°C) prior to SBS testing. SBS values and residual adhesive on the composite surface were evaluated. Analysis of variance showed a significant difference ($P = 0.000$) between the groups. Group 6 had the highest mean SBS (10.61 MPa), followed by group 4 (10.29 MPa). The results of this study suggest that a clinically acceptable bond strength can be achieved by surface conditioning of aged resin composite via the application of hydrofluoric acid, aluminium trioxide particle abrasion, sodium bicarbonate particle abrasion, or a diamond bur.

CONCLUSION

Authors found that there was no advantage or disadvantage in bracket bond strength by pre-curing the primer before placing the bracket and filled component of the adhesive.

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