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Light Curing Durations Affect Shear Bond Strength of Transbond-XT

[1]Mona ALY Abbassy, [2]Ali H. Hassan, [3]Naof Yassen matar, [4]Ahmed S. Bakry

[1,2,3,4] King Abdulaziz University Hospital Jaddah Saudi Arabia

Abstract: **The purpose of this study was to determine the effect of different curing durations using an LED curing light on the shear bond strength of Tran bond XT resin cement used to bond ceramic brackets to tooth structure.**

Materials and methods: Thirty human premolars had their buccal surface bonded to ceramic (3M, Clarity) brackets using Transbond XT under a static constant load for all samples. The resin cement of thirty samples was cured by an LED (Ortholux, 3M Unitek, Minnesota, USA) with an output of 1600 mW/cm2. The teeth were cured for 3, 6, and 10 seconds (n=10). Shear bond strength was carried out to deboned the bonded ceramic using the universal testing machine for all groups.

Results: The 6 and 10 seconds curing by the orthulux light curing scored significantly higher values when compared to the 3 seconds curing (recommended by the manufacturer) while, the 10 seconds curing duration did not show significant difference to the 6 seconds curing $p<0.05$.

Conclusion: Curing the Transbond XT for 6 seconds rather than the 3 seconds curing (recommended by the manufacturer) by ortholux curing unit will improve the bond strength of ceramic brackets to tooth structure.

Keywords: **LED, Ceramic brackets, Shear bond strength.**

1. INTRODUCTION

Esthetics has always been important in the field of orthodontics. Only in recent years, however, has the esthetics of the appliance itself become a subject of major interest. Patients preferred the appearance of these (band less braces) but still desired improved esthetics. To meet this demand, manufacturers marketed brackets made of various type of plastic. Although these brackets received initial acceptance by many clinicians, they were soon abandoned because of slot-dimension distortion and staining. Manufacturers returned to stainless steel but begun designing brackets with increasingly smaller brackets dimensions, thereby reducing the amount of visible metal and improving the appliance. The most esthetic brackets have been constructed of a ceramic martial a single-crystal ceramic. The manufacturers of both of these brackets types claim that their brackets are esthetic and will not stain or distort. They also report that there brackets have high retentive bond strength .To achieve clinically useful bond strengths between brackets and enamel, some manufactures have enhanced the chemical bonding of composite resin to ceramic martial's with silane coupling agents. Several ceramic bracket systems incorporate silane coating with conventional mechanical –lock features. Clinicians have reported that these new ceramic brackets are difficult to depond, although we could not find this claim documented in the literature. With conventional methods of deboning, instances of enamel fracture have been reported, and there is concern that these ceramic brackets bond strongly to enamel that enamel fails before the brackets at deponding. Applying 37phosphoric acid to the enamel for 60 seconds is an accepted and effective methods of etching enamel in preparation for bonding with a resinous matrial.Factors such as acid type, acid concentration, and length of etching time may affect bond strength. Concern with strength of ceramic brackets bonded to enamel may necessitate changing light curing durations techniques in order to decrease the bond strengths. This concept led us to evaluate the in vitro retentive bond strength of ceramic (CLARITY) bracket that had been bonded after a 15 second etching time and different curing duration's time. .

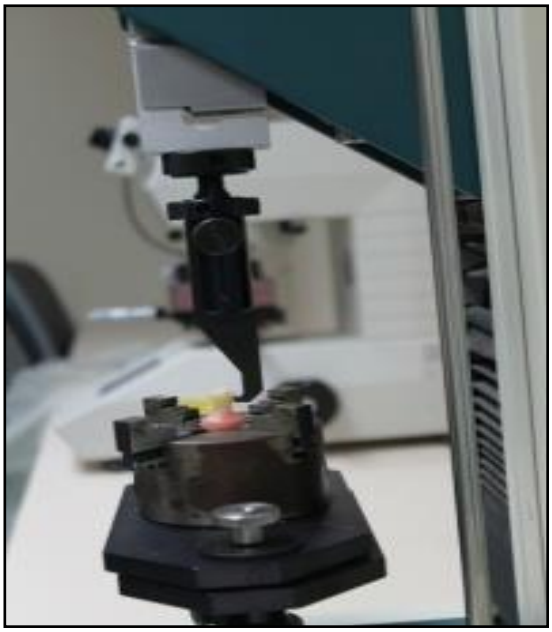

Figure.1

2. MATERIALS AND METHODS

Specimen preparation:

This in vitro testing used 30 extracted human upper and lower anterior and premolars were used for study. After extraction, the teeth were cleaned, stored in a plastic container with distilled water, and at 37 °C. The selection criteria for the teeth were as follows: intact buccal enamel, absence of pre treatment with chemical agents (such as hydrogen peroxide), absence of old orthodontics treatment, and absence of cracks and caries,

The teeth Were fixed in self –curing acrylic resin placed in flexible molds with roots embedded in the acrylic and the crown exposed and oriented perpendicularly to the bottom of the mold. The buccal surface were cleaned with a rubber cup and non-fluoridated pumice – water slurry for 10 s,rinsed with air –water spray for 10 s and air –dried for 10 s.

Figure.2

Clarity ™ ADVANCED Brackets (3M orthodontic products,Monrovia,CA,USA)with 0.022 inch slots were used .the mean surface area of each brackets used is measured by mm².The bonded done with transbond XT under static constant load for all samples.

The 30 samples were randomly divided into two groups: one group was bonded with LED ortholux, 3M Unitek, Minnesota, USA).with output of 1600 Mw/cm² for 10 s, 6 s and 3s. and other group with conventional light for 6 s and 10 s (n=10).The teeth were etched with 37percent phosphoric acid for 30 seconds, washed for 20 seconds, and dried for 10 seconds until the buccal surfaces of etched teeth appeared chalky whiten colour.After etching, a thin uniform coat of primer (transpond XT primer; 3M Unitek, Monrovia, California, USA) was applied. The pre-coated bracket was firmly positioned on enamel surface. Excess adhesive surrounding the periphery of bracket was meticulously removed with an explorer.

Bond strength testing and failure analysis:

Brackets deboning was performed after bonding in a material testing unit (model no 5500, InstronCrop, Canton, MA, USA) with an occlusion-gingival load applied to brackets base. The shearing rod was adjusted each time so the shearing blade is parallel to the base of the brackets contacting in it in a reproducible way each test. The sheer force was applied to brackets by lowering the shear rod perpendicularly in the gingival direction, producing a shear force at bracket- enamel interface. The failure load in Newton was divided by the bracket base bonding area by mm² for each tooth to calculate the shear bonding strength in MPa.

3. RESULTS

The 6 and 10 seconds curing by the orthulux light curing scored significantly higher values when compared to the 3 seconds curing (recommended by the manufacturer) while, the 10 seconds curing duration did not show significant difference to the 6 seconds curing $p<0.05$.

(Bond strength values of Transbond XT bonding ceramic brackets to enamel Connected bars are statistically significant $p<0.05$).

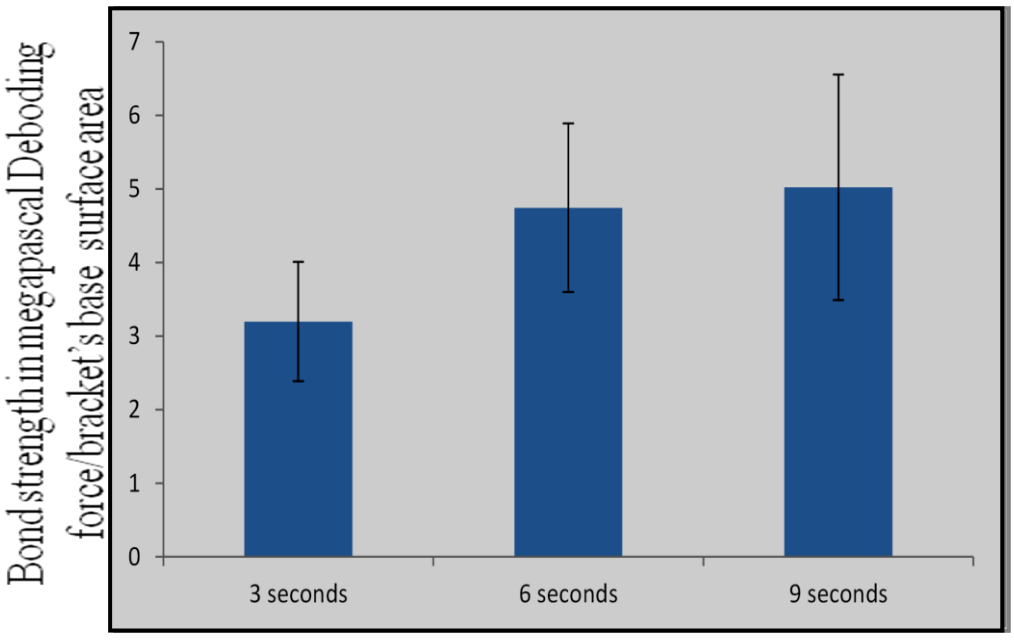

Figure.3

4. CONCLUSION

Curing the Transbond XT for 6 seconds rather than the 3 seconds curing (recommended by the manufacturer) by ortholux curing unit will improve the bond strength of ceramic brackets to tooth structure.

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