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SHEAR BOND STRENGTH OF LUTING CEMENT WITH DIFFERENT CURING METHODS-AN INVITRO STUDY

Jafar Abdulla Mohamed Usman
Substitutive Dental Sciences
College Of Dentistry, King Khaled University
Abha, Kingdom Of Saudi Arabia
drjafara@gmail.com

***Abstract*— — Conventional luting cements have been used to bond all ceramic crowns in fixed partial denture. Bonding of these cements can be done my different methods towards the ceramic and dentin. Bondings of the cements are often initiated by light cure devices. Therefore it necessitates comparing the bond strength of luting cement cured by light cure devices with different curing methods**

***Index Terms*— Bonding, All Ceramics, Shear bond strength, Light cure**

I. INTRODUCTION

Advances in adhesive luting cements have been administered and applied commonly in all ceramic restorations. The ideal property of luting cement are fracture resistant, low solubility, adequate adhesive bond to tooth structure [1].The use of all ceramic crowns for fixed partial denture is a routine part of a dentist nowadays. The clinical performance of all ceramic restorations is influenced by many factors. One such factor is the adhesion between the tooth and the cement luted [2].However these restorations are considered successful only if it can withstand various forces inside the oral cavity. The common failures of these restorations are due to many circumstances and leads to debonding of the crown[3]Many bonding systems are currently available mostly chemical or light activated. Success of bonding absolutely important for success of the crowns. Hence it becomes inevitable to know about the bonding strength by different curing systems

II. MATERIALS AND METHODS

Non carious maxillary human premolars were considered for this study. Sixty maxillary premolars were carefully selected and checked for caries and any previous restorations which if found in teeth were discarded. All the teeth were stored in a prepared isotonic saline solution. Sixty IPS Empress 2(Ivoclar Vivadent, Germany) ceramic disc specimens of 3mm diameter and width of 2mm were fabricated. The teeth were then sectioned at cement enamel junction with diamond disc at ninety degrees to long axis of the tooth and 2mm coronally to obtain tooth disc specimen of 2mm thickness. Upper and lower Plastic mounting plates were fabricated uniformly for 40mm/4mm with machined screw fittings were fabricated. Upper plate holds the ceramic specimen whereas the lower holds the tooth specimen. Panavia F2.O- luting cement was used to cement the two specimens and to standardize the cement a Mylar strip was used. Three types of curing methods were used namely the halogen, Light emitting diode and plasma arc

Class A- The Halogen curing light- light is emitted from white halogen bulb. The light produced is powerful that filters has been placed to limit the heat. This systems was considered as conventional and been replaced by LED or plasma

Class B- Light Emitting Diodes- This technology was introduced by Mills et al .[4]. This technology was introduced as an alternative method for curing various dental materials. LED generates light with narrow wave length. So heat generation is less and filters are not needed.

Class C- Plasma arc lights- Plasma arc bulb gained immense popularity due to its short time for curing. This was a major advantage since the conventional curing systems used more time for curing

The surface of tooth specimen was etched with 37 % phosphoric acid, rinsed and air dried. Dentin bonding agent was applied and light polymerized. Surface of tooth specimen was etched with 9 %hydrofluoric acid followed by silane application. Panavia luting cement (Kuraray, USA) was used for luting the two specimens and curing was done with two different times (Table-1).

III. TESTING PROTOCOL

After photo polymerization specimens were subjected for shear bond strength using Lloyds universal testing machine until the bond failure. Shear load failure was recorded in Newton and stress was converted to Mega Pascal. The fractured specimens were further evaluated for scanning electroscopic examination. The collected data were analyzed statiscally using SPSS to identify differences in mean shear bond strength.

IV. RESULTS

The mean of shear bond strengths of all the groups were analyzed (Table-2). One way ANOVA was used and the level of significance was at P < 0.05. One way ANOVA was used to compare the shear bond strength all the groups which showed no significant difference.

V. DISCUSSION

The most advanced and currently predominant highly esthetic restorative material with optimal properties that can resemble the natural dentition is dental ceramics. Even though it has many advantages, ceramics are fragile under tensile strain. This weakness can be attributed to the presence and propagation of micro flaws present on the surface of the material, making the ceramic susceptible to fracture, thereby making the cementation process very important for the clinical success of all ceramic restorations. The purpose of this study was to evaluate the shear bond strength of three different curing systems.. Due to its widespread popularity and usage, IPS Empress 2 is used in this study. IPS Empress 2 is a lithium disilicate, heat pressed all ceramic material.

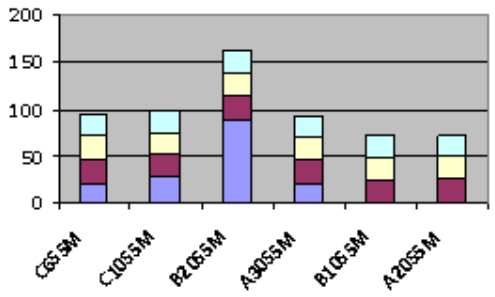
Human premolars extracted for orthodontic purpose were collected. It was then sectioned and mounted on plastic mounting plates with machined screw fittings. Mylar strips ensured uniform film thickness of 40 µm5. The luting agent selected for comparative evaluation is Panavia f2.0 luting cement (Kuraray, USA). Glass ionomer cements were formulated in 1976 as a dental restorative material and has been in major use for more than 30 years for increased patient acceptance. These are primarily adhesive cements containing acid soluble calcium fluoroaluminosilicate glass and aqueous solution of polyacrylic acid in a concentration of about 0-50 % [5]. According to Holand et al, the main crystal phase of IPS Empress 2 glass ceramic is formed by elongated crystals of lithium disilicate. A second phase is composed of lithium orthophosphate. A glass matrix surrounds both crystalline phases. Hydrofluoric acid removes the glass matrix and the second crystalline phase creating irregularities within the lithium disilicate crystals and thereby results in increased bonding6. This is followed by silanization with Monobond S (Ivoclar Vivadent, Liechtenstein).

Silane coupling agents enhances the formation of chemical bond between the inorganic phase of the ceramic and the organic phase of the resin and increases the wettability of ceramic surface[6].Other methods of surface treatment of ceramics include sandblasting with 50µm aluminium oxide particles, surface roughening with coarse diamond bur, etching with 40% phosphoric acid solution[7]. Shear bond strength were calculated by dividing the force at which the bond failure occurred by the specimen bonding area. The results obtained were then statistically analyzed by one way analysis of variance (ANOVA). Six groups after the testing analyzed show no significant differences after debonding (P<0.05). This indicates that all the three curing systems shows equal potential and can be used. .Failure analysis through SEM examination revealed predominantly cohesive failures at the resin-dentin and ceramic-resin interfaces for both Class B and Group C luting cement in accordance with studies done by R.Janda(2002)[8]

TABLE I. THREE DIFFERENT CURING SYSTEMS, TWO CURING TIMES

HALOGEN		LED		PLASMA ARC	
A 20 S	A 40S	B 10 S	B20 S	C 6 S	C 10 S

TABLE II. MEAN SHEAR BOND STRENGTHS



VI. CONCLUSION

With the limitations of this study it would appear that all the three methods of curing systems achieved equal and adequate shear bond strength. This in vitro study allowed an immediate assessment of the bond created between the cement and the restorative material. It is acceptable, to compare the measured in vitro results obtained in a controlled environment. But, these tests cannot adequately simulate clinical situations with all the detail. The compulsive and final evaluation of material performance should be determined using long term clinical studies and trials.

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