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Comparative Evaluation Of Effects Of Various Tooth Preparation Cleansing Protocols On The Bond Strength Of Provisional Cement To Contaminated Dentin - An In - Vitro Study

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Abstract:

Introduction: The provisional luting cement is required to be removed from the dentin surface prior to final cementation. The disadvantage of chemical cleansing agents is that their effectiveness occurs only on the superficial layer of the dentin and an additional mechanical cleansing protocol may be necessary. This study is conducted to evaluate the bond strength after following mechanical cleansing protocols.

Material & method: Extracted human premolars were flattened to expose the dentin surface and prepared for full crown preparation. Acrylic temporary crowns were made and placed using provisional cement. The specimens were stored at room temperature with 90% relative humidity for seven days. Following removal of the provisional crowns, the specimens were randomly divided into three groups, and excess provisional cement was removed with 1) a hand instrument (excavator), 2) excavator followed by prophy with a mixture of flour pumice and water 3) excavator followed by sodium bicarbonate abrasion powder. The PFM crowns were cemented with glass ionomer luting cement. The shear bond strength was determined at a crosshead speed of 0.5 mm/minute. The results were analyzed with one-way ANOVA, followed by Tukey's test.

Result: On comparing the mean shear bond strength in 3 groups by using multiple comparison tukey's test, statistically no significant difference was found (P>0.05).

Conclusion: Irrespective of the tooth cleansing protocol selected, there was no difference in the bond strength of self-adhesive luting cement to dentin following by eugenol-free provisional cement.

Keywords: Excavator, flour pumice, sodium bicarbonate, glass ionomer luting cement.

I. INTRODUCTION

The known key factors that influence the retention and longevity of any definitive restorations are factors such as tooth preparation design, type of definitive luting cement and tooth surface management (1,2). A major influencing criterion turns out to be adequate adhesion between the restoration and the underlying tooth structure. A better retention and marginal adaptation are achieved when a durable and high-quality bonding is obtained between the dental substrate and the prosthetic crown, which prevents microleakage and increases fracture resistance of the restored teeth and indirect restorations. The primary use of a provisional restoration placed with temporary luting cement is to avoid sensitivity, infection and tooth movement during the period of fabrication of indirect restorations. It is imperative that temporary cement is removed as completely as possible prior to seating of the definitive restorations, although removing remnants with an excavator is reported to be difficult (3,4). Simple mechanical cleansing methods might partially remove the oily, greasy

additives of the cement but remnants of the temporary luting cement can still be observed microscopically on the dentin surface after cleaning, while the surface appeared clean macroscopically (5-7).

Irrespective of the definitive luting cement used, whether conventional or resin-based cement, an effective tooth preparation cleansing protocol seems to be an indispensable protocol so as to avoid any obstruction along the interface between the dentin surface and luting cement. Various attempts for tooth preparation cleansing protocols have been proposed which includes a chemical cleansing agent and a mechanical cleansing protocol. The disadvantage of the chemical agents is that their effectiveness occurs only at the superficial layer of the dentin and an additional mechanical cleansing protocol might be needed.

A mechanical cleansing protocol generally includes rotary instrumentation with pumice, an air polisher or micro- particle abrasion system. Several investigations involving rotary instrumentation with pumice indicated that it is more effective in removing residual temporary cement when compared to a chemical cleansing agent (0.12% chlorhexidine gluconate) and an explorer/air-water technique, alone.(2,8) Schwartz et al. (9) reported that pumice efficiently removed remnants from dentin surfaces, while Paul et al. (10) reported otherwise. Yap et al. (11) removed remnants mechanically with the help of an ultrasonic scaler, and then cleaned the dentin surfaces with pumice - water slurry. However, other studies reported contradictory results, indicating that pumice may not be very effective in every situation. (12,13)

Although the influence of temporary cement on dentin bonding has extensively been researched, only limited information is available regarding comparisons of the different protocols for removing remnants and resultant dentin bond strength. Therefore, this study evaluated the in vitro bond strength of a self-adhesive luting cement by using three different techniques to remove surface contamination on dentin i.e. dentin specimens, which were primarily subjected to temporary cementation.

II. MATERIAL AND METHOD

- ✓ Extracted human premolars were selected which showed no evidence of caries and restoration or with any cracks or fractures in the crown.
- ✓ After extraction, the teeth were kept hydrated in distilled water at room temperature and, during the preparation; each tooth was held in water-moistened gauze.
- ✓ Each tooth was mounted in an acrylic block with the buccocementoenamel junction 3 mm above the top with the help of a surveyor. The axial surface of the prepared teeth was aimed parallel with the long axis of the teeth.
- ✓ Tooth preparation was done exposing the dentin for metal ceramic crowns.
- ✓ Provisional crowns were made using acrylic resin (DPI Self cure tooth moulding powder) and provisional cementation (GC Freegenol Temporary Pack) was done.
- ✓ The excess provisional luting cement was removed and the specimens were stored at room temperature and 90% relative humidity (Environmental Chamber, Kumar) for seven days prior to bonding with metal-ceramic crowns.
- ✓ After seven days, the provisional crowns were removed, along with the remaining cement particles, and the teeth were randomly divided into 3 groups and the dentin surfaces was cleaned with:
  - Group A: Excavator. (n=16)
  - Group B: Excavator + flour of pumice and water. (n=16)
  - Group C: Excavator + Sodium bicarbonate powder and water. (n=16).
- ✓ Metal ceramic crowns were fabricated and bonded to the prepared teeth using the glass ionomer luting cement (GC Fuji type 1 luting cement). The mixed cement was directly applied to both the prepared teeth and the crown. The crown was seated with finger pressure, and the excess cement was removed with an explorer after initial setting.
- ✓ The bonded specimens were kept in a dry condition for approximately 30 minutes (starting when the cements were mixed, the ceramics were bonded to the teeth, the cement excess was removed from the initial set until the cements were completely set) to ensure that metal-ceramic specimens are successfully bonded to the teeth, then stored at room temperature and 90% relative humidity for 48 hours (Environmental Chamber, Kumar) prior to the shear bond strength test.
- ✓ Each specimen was mounted onto a metal holder in the universal testing machine (ACME Engineers, Model UNITEST-10, India), and the load was applied with a pointed-rod (custom made) (Figure 1).
- ✓ Each specimen was tightened and stabilized to ensure that the edge of the shearing rod was positioned as close to the ceramic-tooth interface. A shear load was applied at a crosshead speed of 0.5 mm/minute until failure. The ultimate load to failure was recorded in Newton (N). The average bond strength (MPa) was calculated by dividing the maximum ultimate load to failure (N) by the bonded cross- sectional area (mm^2). The mean and standard deviations were recorded.

STATISTICAL ANALYSIS

Statistical analysis was done by using descriptive and inferential statistics using One-way ANOVA test (F=2.409, P=0.101) and Multiple comparison Tukey's test (P>0.05) to define significant differences at a confidence level of 95%. This determined whether significant differences existed in bond strength between the testing groups.

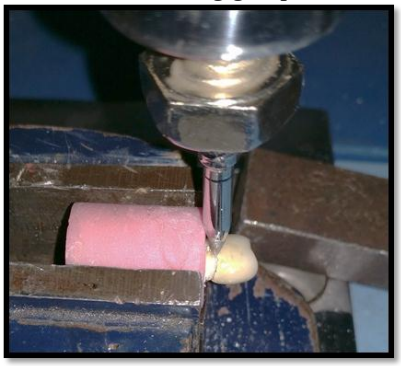

Figure 1: Mounted specimen in universal testing machine

III. RESULTS

- ✓ No significant differences were found in bond strength, resulting from the different tooth preparation cleansing protocols (Table 1). Mean shear bond strength in Group A was 9.11±2.15, in Group B it was 9.94±2.54 and in Group C was 10.89±2.16. Comparatively particle abrasion treatment of dentin with sodium bicarbonate particles provided the highest values of bond strength using self-adhesive luting cement, while with hand excavator alone was the lowest ($p<0.05$).
- ✓ By using one way ANOVA, statistically no significant variation was found amongst the 3 groups. ($F=2.409, p = 0.101$) (Table 2).

On comparing mean shear bond strength amongst three groups by using multiple comparison Tukey test, statistically no significant difference was found ($p>0.05$) (Table 3).

Group	N	Mean (MPa)	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Group A	16	9.11	2.15	0.53	7.96	10.25	6.85	13.85
Group B	16	9.94	2.54	0.63	8.58	11.29	5.58	13.80
Group C	16	10.89	2.16	0.54	9.737	12.04	6.40	15.04

Table 1: Comparison of shear bond strength in three groups - Descriptive Statistics

Source of variation	Sum of Squares	df	Mean Square	F	p-value
Between Groups	25.42	2	12.71	2.409	0.101,NS
Within Groups	237.44	45	5.27		
Total	262.87	47			

Table 2: One way ANOVA

Group		Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Group A	Group B	0.82	0.81214	0.568,NS	1.14	2.79
	Group C	1.785	0.81214	0.083,NS	0.18	3.74
Group B	Group C	0.95	0.81214	0.475,NS	1.01	2.92

Table 3: Multiple Comparison: Tukey Test

IV. DISCUSSION

Any temporary luting cement is required to be removed from the dentin surface prior to definitive cementation. Contradictory results are reported with regard to bond strength to dentin after placement and removal of temporary luting cement. Some studies found that eugenol containing cements have adverse effects on the bond strength of the definitive restoration. These effects include changes in wettability, reactivity of the dentin and interaction with the polymerization of resin-based materials (14-17). This dictated the use of eugenol free luting cement for the study.

A seven-day period is reasonable for temporary restorations placed in clinical situations. After seven days following temporary cementation, the provisional restorations were removed and three different mechanical cleansing protocols were utilized. The surfaces were then vigorously rinsed with water spray after the cleansing protocol was done. It was noticed that major particle remnants were removed in the groups with flour of pumice and sodium bicarbonate particle abrasion as any remaining particles could interfere with the chemical bond and micromechanical retention of the luting cement, resulting in lower bond strength.

As limited information is available regarding comparisons of the different protocols for removing provisional cement remnants and its effect on resultant dentin bond strength, this study evaluated the in vitro bond strength of self-adhesive luting cement.

Limitation of this study is that since mechanical cleansing is an operator-controlled step, so the amount of pressure exerted on the tooth surface while performing these procedures cannot be standardized.

V. CONCLUSION

Within the limitations of this study, using various cleansing protocols for dentin prior to definitive cementation did not significantly affect the bond strength of glass ionomer luting cement to dentin following the use of eugenol-free temporary cement.

REFERENCES

[1] Ayad MF, Rosenstiel SF & Hassan MM (1996) Surface roughness of dentin after tooth preparation with different rotary instrumentation The Journal of Prosthetic Dentistry 75(2) 122-128.
[2] Grasso CA, Caluori DM, Goldstein GR & Hittelman E (2002) In vivo evaluation of three cleansing techniques for prepared abutment teeth The Journal of Prosthetic Dentistry 88(4) 437-441.
[3] Terata R, Nakashima K, Kubota M (2000) Effect of temporary materials on bond strength of resin-modified glass-ionomer luting cements to teeth. Am J Dent 13, 209-211
[4] Kanakuri K, Kawamoto Y, Kakehashi Y, Matsumura H (2005) Influence of temporary cements on bond strength between resin-based luting agents and dentin. Am J Dent
[5] Watanabe EK, Yamashita A, Imai M, Yatani H & Suzuki K (1997) Temporary cement remnants as an adhesion inhibit- ing factor in the interface between resin cements and bovine dentin The International Journal of Prosthodontics 10(5) 440-452.
[6] Watanabe EK, Yatani H, Ishikawa K, Suzuki K & Yamashita A (2000) Pilot study of conditioner/primer

effects on resin- dentin bonding after provisional cement contamination using SEM, energy dispersive x-ray spectroscopy, and bond strength evaluation measures The Journal of Prosthetic Dentistry 83(3) 349-355.

[7] Terata R (1993) Characterization of enamel and dentin sur- faces after removal of temporary cement—study on removal of temporary cement Dental Materials Journal 12(1) 18-28.

[8] Button GL, Moon PC, Barnes RF & Gunsolley JC (1988) Effect of preparation cleaning procedures on crown retention The Journal of Prosthetic Dentistry 59(2) 145-148.

[9] Schwartz R, Davis R, Hilton TJ (1992) Effect of temporary cements on the bond strength of aresin cement. Am J Dent 5, 147-150

[10] Paul SJ, Scharer P (1997) Effect of provisional cements on the bond strength of various adhesive bonding systems on dentine. J Oral Rehabil 24, 8-14

[11] Yap AU, Shah KC, Loh ET, Sim SS, Tan CC (2001) Influence of eugenol-containing temporary restorations on bond strength of composite to dentin. Oper Dent 26, 556-561

[12] Paul SJ & Scharer P (1997) Effect of provisional cements on the bond strength of various adhesive bonding systems on dentine Journal of Oral Rehabilitation 24(1) 8-14.

[13] Bachmann M, Paul SJ, Luthy H & Scharer P (1997) Effect of cleaning dentine with soap and pumice on shear bond strength of dentine-bonding agents Journal of Oral Rehabilitation 24(6) 433-438.

[14] Rosales-Leal JI, Osorio R, Toledano M, Cabrerizo-Vilchez MA & Millstein PL (2003) Influence of eugenol contamina- tion on the wetting of ground and etched dentin Operative Dentistry 28(6) 695-699.

[15] Baier RE (1992) Principles of adhesion Operative Dentistry Supplement 5 1-9.

[16] Millstein PL & Nathanson D (1992) Effects of temporary cementation on permanent cement retention to composite resin cores The Journal of Prosthetic Dentistry 67(6) 856-859.

[17] Xie J, Powers JM & McGuckin RS (1993) In vitro bond strength of two adhesives to enamel and dentin under normal and contaminated conditions Dental Materials 9(5) 295-299.