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Comparison of marginal adaptation between all ceramic crown and full cast crown with two different luting cement (In Vitro study)

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Aims of This study

The purpose of this study to evaluate and compare the marginal adaptation of all ceramic crown used full cast crown using two different luting cement agent in vitro study.

Abstract

The purpose of this study was to determine and evaluate the micro leakage and fit of all ceramic crown and full cast metal crown using two different luting agent. Twenty four recently caries free wisdom teeth were used .
The teeth were cleaned and checked with magnifying lens.

Noticed any cracks or caries . Specimens remained in distilled water at room temperature . Each specimen were centrally inserted in cylinder 20mm height and 20mm internal diameter containing self curing acrylic resin . Preparation were completed at the dentin level of the cement -enamel junction with a chamfer finish line 1.2mm all round tooth . The height of preparation was 7mm with a convergence angle of six degree using diamond bur (Germany, No 878, 2012) . Prepared teeth were divided in two main groups (n=6) .

Group A: All ceramic crown(12-Specimens) . Subdivided in two subgroup.

A1:- (6) Specimens used the zinc-phosphate cement. A2:- (6) Specimens used resin cement . Group B :- Full cast crown (12-Specimens). Subdivided in tow subgroup Group B1 :-(6) Specimens used zinc-phosphate cement Group B2:- (6) Specimens used resin cement .

After 24hr of storage in distilled water at 37c , all the specimens immersed in 0.5% basic fuchcin dye for 24hr.Fallowing removal from the solution , each tooth was vertically sectioned bucco-lingually with water-cooled diamond disc . Stereomicroscope at 40 magnification was to study the extent of microleakge, which was indicated by the dye pentration recorded at both metal-cement(MC) and tooth-cement (TC) interface . Microleakge was done according to the index proposed by Tjan etel[1] .

The data of all 4 groups was analyzed with one-way analysis of variance with student T-test was used to compare the microleakage scores within the groups at both the interface. The data obtained in this study show statistically significant difference in microleakage level between group A and B and between subgroup of specimens.

The conclusion of this study , resin cement recorded less micro leakage in both all ceramic crown, and metal cast crown Than zinc – phosphate cement , because The self

curing nature with low curing rate, give rapid and superior adhesion to both dentin and restoration and better mechanical properties

Key words : Composite, Micro leakage, Bond Etch, Curing, Ceramic

Introduction

The different materials and applied techniques in the manufacturing of crown systems have significant effects on the strength of the final restoration as well as the marginal fit. All-ceramic restorations must satisfy the clinical requirements in these respects to be considered successful. Minimizing the marginal gap is also necessary because an increase in the marginal gap results in an increase in cement dissolution, thus increasing the potential for microleakage[2]

Despite the material and advancement laboratory techniques , cement lines are used in fixed prosthodontics and some degree of marginal discrepancy is always expected that marginal adaptation of cemented crown is never prefect and the cast restorations usually display a marginal discrepancy this lead to increased dependence on the integrity of the cement to maintain the marginal seal[3]

At present , There is no luting cement with zero or complete insolubility in the oral environment, and due to solubility of luting cement in general have been described as "weak link" in restoring teeth with cast restoration[4]. The cement therefor must have a good mechanical properties , be as stable as possible in the oral environment , should have a good adhesion to the tooth structure as well as to restoration to resist bacterial penetration . luting agent offering a high degree of bonding strength and relative insolubility in the oral environment have shown to have a negative impact on microleakage around the restoration[5].

Metal ceramic crowns are an example of full coverage restoration that has been widely used, although metal-ceramic crown possess high strength restoration, in the more aesthetically restoration over the last few years has stimulated the development of all-ceramic crown restorations. There have been many studies on the effect of luting agent on the microleakage and evaluation of marginal fit of different crown system[6].

Materials & Method

24 recently extracted caries free wisdom teeth were used . The teeth were cleaned and checked with x10 magnifying eye lens, specimens remained in distilled water at room temperature . The Teeth were centrally inserted in cylinder (20 mm height x 20 mm internal diameter, containing – self curing acrylic resin . The acrylic resin was maintained 2mm below to cement – enamel Junction, and stored in water until use . The specimens were assigned randomly in four groups . The preparation of teeth were made with a diamond burs of 1.2 mm diameter to achieve a (6) degree converge angle in high-speed hand–piece by mean of stationary hand-piece to achieve optimal retention, and resistance properties . The occlusal and axial surface were reduce by approximately "1.2" and "0.8" receptively. The cervical preparation margin were designed as circular chamfer using taper shaped diamond burs, and water cooling (lemgo, Germany , No 878 size 12) . The preparation were finished and cheeked with magnifying lenses x10 .

The lines angles were rounded. The margin was localized along is full length to The dentin at level of cement to

enamel Junction . In impression was made for each tooth with silicon rubber base (zhremack) impression materials . crown were constricted by means of indirect laboratory technique by specialist . The preparations were polished using rotary brush and pumice .

Group A (12) specimen (ceramic crown) , these grope subdivided in tow subgroup, each subgroup have (6 specimen) subgroup A1 were cemented with zinc-phosphate cement, and sub group (A2) were cemented with resin cement .And group (B) with metal cast elso subdivided in two subgroup, subgroup (B1). were cemented with zinc phosphate cement, and sub group (B2), were cemented with resin cement, all The cement type were mixed according to manufacture instruction . For all groups The cement mixture was applied on to internal crown surface, and mounted on The prepared tooth by compression to the exposed immediately to 5kg load for 10 minutes that allowed cement flow and correct crown fill on the preparation . Excess material was removed with a sharp explorer . final crown adaptation was considered acceptable when no discrepancies were detected . The samples were immersed in to 1% fuchcin dye solution for one hour at 37 c^o , rinsed, dried, and cut using 1mm thick diamond gauge disc parallel to The axial tooth axis in the direction bucco-lingually of each specimen for measurement of dye penetration degree. The linear penetration of dye starting from the restorative crown margins, and determined with a stereo microscope (40 magnification) (Zerss, Dber Kochen, Coeman). Marginal gap were measured as defined by Holmes [8] . Microleakage was measured in millimeters for the two types of cement used . The distance between the prepared tooth surface, and the crowns fitting surface was measured at and recorded.

Result

From this table I , its shown that there is a statistically significance difference in compering with group (A2) when used resin cement.

From this table II , its shown that there is a statistically significance difference in compering with group (B2) when used resin cement.

Discussion

Cement disintegration or dissolution in oral fluid effect on strength and weakening of The bond between The cement and dentine or cement and restoration causes microleakage and loss of bonding effect[9].

multiple factors ranging from non retentive Tooth preparation , poor casting fit, poor cementing technique, and the type of luting cement agent, the mechanical properties has significant effect on micro leakage .

Cement with high modulus of elasticity is important to prevent micro leakage[10]. Water soluble cement (zinc phosphate cement) are susceptible to tensile failure while resin cement (with higher tensile strength) are prone to Fail Through cyclic fatigue stress[11].

The comparison of sup group (A1, B1) were cemented with resin cement , it shown no significance difference between these sup group .This result coincide with finding of Nadia[12] , who demonstrate the resin cement have chemical adhesion to tooth and affinity for metal ions and fluoride release can promote optimal sealing. However, inherent polymerization shrink, and high coefficient of thermal expansion are potential concerns with resin based luting agent.

These stresses may exceed the adhesive, and cohesive strength of the material resulting in the formation of The marginal gap at The point of weakest bond leading to marginal leakage at The interface[13] . While when comparison of sup group (A2 , B2) were

cemented zinc phosphate cement its shown significance difference , between sup group . This result coincide with finding of Hansen [14] demonstrate That acid component of phosphate cement may demineralized smear layer and intact dentin and exposed collagen fibers hydrolysis over time under influence of oral fluid, and water, In spite of, its well documented disadvantage, such as high clinical solubility, lack of adhesion, and low setting PH.

Davidson et al]15], revealed the importance of bond formation between The resin cement, and The interface with hygroscopic expansion to counteract stress accurse immediately, while adequate compensatory hygroscopic gap, and decreasing The marginal gap. There for , polymerization shrinkage occurs immediately, while adequate compensatory hygroscopic expansion would require one hours or days. There for, The immediate bond strength to dentin is crucial to resist the combined forcers of polymerization shrinkage .

If adhesion to dentine is lost at the time of resin polymerization , any compensator hygroscopic expansion cannot completely seal This interface[16].Resin cement recorded les microleakage in both all ceramic crown, and metal cast crown Than zinc – phosphate cement , because The self curing nature with low curing rate give rapid and superior adhesion to both dentin and restoration and better mechanical properties]17].

So from this study , revealed the luting agent effect on micro leakage more than the types of crown restoration.

Conclusion

There is a significant difference between resin and zinc – phosphate cement. There is no significant difference between sup group cemented with resin cement.

The types of luting agent effect on degree micro leakage more than of crown restoration.

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Table1:- data of marginal leakage at both metal cement and tooth cement interface for all ceramic crown.

	Zinc phosphate cement		Resin cement	
Sample	TC	MC	TC	MC
1	1	0	1	0
2	2	2	0.5	1
3	0	1.5	0	0.5
4	1.5	1	0.5	1
5	3	1	1	0
6	1	0.5	0	0.5
Mean	1.58	1.0	0.6	0.3

Table 2:- data of marginal leakage at both metal cement and tooth cement interface for all metal cast crown.

	Zinc phosphate cement		Resin cement	
Sample	TC	MC	TC	MC
1	1	0	1	0
2	3	2	0.5	0.5
3	1	3	2	1
4	2	1	1	0
5	0.5	1	0.5	2.5
6	1	4	0	1
Mean	1.416	1.66	0.833	0.75

Table 3 :- Mean , standard deviation with minimum and maximum rate of microleakage scores at tooth cement interface and metal cement with zinc phosphate for all ceramic crown

groups	Cement	Interface	N	mean	S.D	minimum	Maximum
A1	Zinc phosphate cement	TC	6	1.58	0.7230	0	3
		MC	6	1.0	1.218	0	2.5
A2	Resin cement	TC	6	0.6	0.8722	0	1
		MC	6	0.3	0.9892	0	1

Table 4 :- Mean , standard deviation with minimum and maximum rate of microleakage scores at tooth cement interface and metal cement with zinc phosphate and resin cement for all metal cast crown

Groups	Cement	Interface	N	mean	S.D	minimum	Maximum
B1	Zinc phosphate cement	TC	6	1.416	1.223	0	3
		MC	6	1.66	1.452	0	4
B2	Resin cement	TC	6	0.75	0.963	0	2
		MC	6	0.831	0.67	0	2

TC : Tooth cement interface
MC: Metal cement interface

Table 5:- Comparison between sub group A1 and B1 for all ceramic crown and metal crown , it is shown that there is statistically significant difference ($p<0.05$) between the two different materials used in this study.

Interface surface	N	mean	S.D	T. value	P.V	Significance
TC	6	158	1.7230	2.43	0.4	Significant
MC	6	1.66	0.482			

Table 6:- Comparison between sub group A2 and B2 for all ceramic crown and metal crown , it is shown that there is no significant difference ($p>0.05$) between this materials used in this study.

Interface surface	N	mean	S.D	T. value	P.V	Significance
TC	6	1.0	0.8722	0.852	0.3	No Significant
MC	6	0.3	0.422			