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Comparative Evaluation Shear Bond Strength of Resin Composite Cement to Coronal Enamel, Cementoenamel Junction and Root Cementum: An in Vitro Study

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Abstract | **Original Research Article**

Aim: To compare shear bond strength of resin composite cement to coronal enamel, cementoenamel junction and root cementum. ***Materials and Methods:*** Twenty one extracted human permanent teeth were selected and randomly divided into three groups(n=21) according to area of adhesion. group 1(n=7): coronal enamel. group 2(n=7): cementoenamel junction. group 3(n=7): root cementum. An area of 5mm x 5mm was selected on tooth of each specified group. Area was etched for 15 seconds with 35% phosphoric acid and washed off. Bonding agent was applied on area and light cured, composite was applied and light cured for 30 seconds. Teeth were mounted in acrylic resin and stored in distilled water. Specimens were subjected to shear load using universal testing machine at cross head speed of 0.5mm/min. ***Results:*** According to results obtained from the study comparative shear bond strength (in Mpa) of resin composite cement to coronal enamel, cementoenamel junction and root cementum, highly statistically significant ($p<0.001$) difference was observed among three groups**.** ***Discussion:*** The cervical area of teeth is most unpredictable region for durable adhesive bonding. This study was performed to evaluate adhesion potential of composite cement to coronal and cervical structures of teeth. ***Conclusion:*** Under this study, we can conclude that adhesion to root cementum is less favorable compared to adhesion to CEJ and coronal enamel.

Keywords: cementoenamel junction, resin, Teeth, root cementum.

INTRODUCTION

The cervical area of tooth is the most unpredictable region for durable adhesive bonding of tooth. The differences in tooth structure at different locations significantly dictate adhesion of resin bonded materials [1]. For instance, enamel prism exhibits frequently disturbed arrangement in cervical region while in coronal region these prisms exhibit more organized pattern. The CEJ is a complex area where different hard tissues of tooth come together, their distribution at CEJ is unpredictable and irregular in all individual teeth Therefore, abrasion of cej due to aggressive tooth brushing. biofilm or acidic beverages may result in wear or defects in this region [2]. The cementum around CEJ is acellular and afibrillar. the coronal two thirds of root is covered by a thin layer of acellular extrinsic fibre cementum [3]. Adhesion promoters build a hybrid layer on dental substrate as a result of resin component impregnating the enamel and dentin microstructure [4]. With the advances in the field of adhesive dentistry, the treatment spectrum for reconstructions was broadened and direct or indirect resin composite restorations and ceramic veneers have become successful options to restore the anterior teeth due to caries, trauma or optical reasons [5,6].

The minimally invasive treatment depends up on the ability of resin composites adhere to the tooth. The

long-term retention of porcelain veneers, a strong and stable bond between the luting composite and the tooth is essential [7]. The differences in tooth structure at different locations significantly dictate the adhesion of resin-based materials. The treatment of periodontal diseases can result in gingival recessions and exposed root surfaces in the anterior tooth area, which is for many patients is the reason to seek treatment with veneers. debonding could yield to not only optical but also other problems such as secondary caries, post-operative sensitivity and plaque accumulation [8-10].

The CEJ is a complex area where different hard tissues of the tooth come together, namely enamel overlapped by cementum; enamel and cementum edge-to-edge; a gap, revealing a strip of exposed dentin; and cementum overlapped by enamel [11]. In addition to the anatomic and morphological variations on the tooth substrate, the adhesive system plays also an important role on the level of adhesion achieved [12]. the adhesive resin types can be classified into two main subgroups: etch-and-rinse and self-etch systems. In clinical success of adhesive material, the bond strength is very important. The high bond strength helps adhesive to resist against stresses caused by resin contraction and forces which are applied in area between tooth and restoration [13]. The shear bond strength is one type of tests used for evaluating bond strength. The shear bond strength (SBS) is the maximum force which adhesive joint can tolerate before fracture. This force is applied to adhesive area between two materials [14]. The objective of this study, was to compare shear bond strength of resin composite cement to coronal enamel, cementoenamel junction and root cementum.

MATERIAL AND METHODS

This experiment study was performed on 21 extracted permanent teeth. Teeth were cleaned up of soft tissues and debries, and initial 24 hrs used 0.5% chloramine-T solution for, and then in water for store of extracted teeth. and also in room temperature. Materials used for the study were 21 extracted Teeth, Airrotor, SF-41 bur, Etchant, Bonding agent, Composite, Light curing gun, Applicator tip, Teflon coated composite instruments The teeth were mounted in self-cure acrylic resin up to CEJ region, with the help of a surveyor vertical barin the way that enamel smooth surface were placed perpendicular to the horizon. The teeth were randomly divided into 03 groups. Group 1 (n=7) Coronal enamel was prepared, Group 2 (n=7) CEJ was prepared, Group 3 (n=7) Root cementum was prepared.

Methodology: For group 1 Coronal enamel was prepared, etched, bonded and composite resin was applied. Preparation of 5mm x 5mm x 1mm was done, for group 2 CEJ was prepared, etched, bonded and composite was applied. Preparation of 5mmx5mmx1mm was done and for group 3 Root cementum was prepared. Etched, bonded and composite was applied. Preparation of 5mmx5mmx1mm was done. Area was etched for 15 seconds with 35% phosphoric acid and washed off. Bonding agent was applied on area and light cured, composite was applied and light cured for 30 seconds.

The samples were placed in Testomeric machine, and the bonding surface of tooth was parallel to device chisel-shape blade. The blade was placed in composite-enamel interface, and force was applied tosamples with the cross-head speed of 0.5 mm/min and with the load cell of 50 kgf, when break down was occurred. The force needed to breakdown each samples was recorded in Newton and converted to megapascal (MPa) with below equation: Shear bond strength (MPa): Peak load in break zone (Newton)/ bond surface (mm2). The statistical analysis was executed using the statistical software SPSS Software V.20, Chicago, IL, USA. After checking the normality of the data with Kolmogrov-Smirnov test, Two- way ANOVA and Tukey, HSD were used. For assessing "Mode of failure", fisher's exact test was used.

RESULTS

The mean shear strength bond between all three groups measured. Group 1 the mean strength is 5.83 Mpa, Group 2 the mean strength is 4.52 Mpa and Group 3 the mean strength is 3.27 Mpa. (Table 1) (Graph 1).

According to results obtained from the study comparative shear bond strength (in Mpa) of resin composite cement to coronal enamel, cementoenamel junction and root cementum, highly statistically significant ($p<0.001$) difference was observed among three groups**.**

Adhesion to enamel is typically achieved after etching enamel with phosphoric acid that creates a highly micro-retentive surface that is easily wetted by hydrophobic resin based adhesives. Thus etched enamel provides excellent micromechanical retention.

As for CEJ or root cementum adhesion in these zones have more clinical implications in that microleakage is experienced as a result of deterioration of bond at margins of restoration.

Root cementum in the cervical area belongs to acellular extrinsic fiber cementum composed of sharpey's fibers where overall mineralization is about 45-60%.

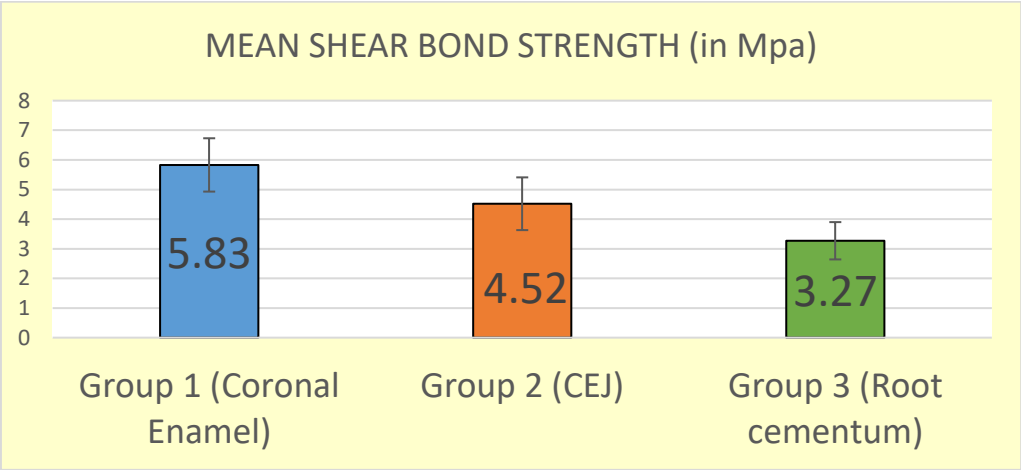
Cementum contains 50% organic matrix and predominantly type 1 collagen. So bond strength is significantly lower than enamel.

Table 1

	Mean	SD	One way Anova 'F' test	p value, Significance
Group 1 (Coronal Enamel)	5.83	0.9	F = 16.909	p<0.001**
Group 2 (CEJ)	4.52	0.89		
Group 3 (Root cementum)	3.27	0.63		

p>0.05 – no significant difference ***p<0.05 – significant** ****p<0.001 – highly significant**

Graph 1.



DISCUSSION

During composite polymerization, resin contraction induces stress in bonded area and pulls it from cavity walls. Stresses caused by chewing and thermal and chemical situations can affect the quality of bond [14]. The results of present study are similar to some other studies which compared self-etch and etch-and-rinse adhesive systems [8-10].

According to one SEM study, resin tags which formed in enamel after self-etch adhesives' application was lesser and with lower depth of penetration in comparison with etch-and-rinse adhesives [15]. In present study we found Cementum contains 50% organic matrix and predominantly type 1 collagen. So bond strength is significantly lower than enamel. Microleakage is experienced as a result of deterioration of bond at margins of restoration at CEJ or root cementum. Adhesion to enamel is typically achieved after etching enamel with phosphoric acid that creates a highly micro-retentive surface that is easily wetted by hydrophobic resin based adhesives. Thus etched enamel provides excellent micromechanical retention. The cervical area of teeth is most unpredictable region for durable adhesive bonding.

CONCLUSION

Under this study, we can conclude that adhesion to root cementum is less favorable compared to adhesion to CEJ and coronal enamel.

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