

Original Research

Comparative Evaluation of bond strength of total etch and self etch adhesives before and after contamination with saliva

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ABSTRACT:

Background: Adhesive dentistry has been progressing rapidly over the past decade. It is very important to maintain dry operating field for the application of bonding agent. The presence of moisture can alter the bond strength of the bonding agents. The present study was conducted to evaluate the bond strength of self- and total-etch adhesive systems on enamel and dentin before and after contamination with saliva. **Material and methods:** The present study was carried out on 90 orthodontically extracted premolars with the aim to evaluate the effect of saliva contamination on the bonding strength of self- and total-etch adhesive systems on enamel and dentin. Adhesive systems used in the study were Self-etch adhesive system and Total-etch adhesive system. Each group was further subdivided randomly into three subgroups of fifteen teeth each depending on the type of contamination subjected to and the steps in the bonding sequence when contamination occurred that was before or after adhesive application. The bonding strength was measured in a universal testing machine at a crosshead speed of 1 mm/min. The collected data were statistically analyzed using two-way ANOVA. **Results:** The result of the study shows that comparison of mean bonding strength of total-etch adhesive which was applied after saliva contamination is less than self-etch adhesive applied after saliva contamination. The bond strength of total-etch adhesive applied before saliva contamination is more than the bond strength of self-etch adhesive applied before saliva contamination. The mean bond strength of total-etch adhesive control is less than self-etch adhesive control group.

Conclusion: Our study concluded that the bonding strength of self-etch adhesive system was better than the total-etch adhesive system.

Key words: Adhesive, total-etch, self-etch

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INTRODUCTION:

Adhesive systems are classified based on adhesion scheme used as follows: total-etch, self-etching and glass ionomer-based.¹ The word adhesion is derived from the Latin word adhaerere, which means to stick. Adhesion refers to the forces or energies between atoms or molecules at an interface that hold two phases together.² Development in bonding agents has moved from multistep bonding process (etching, washing, drying, primer, adhesive) to simplification i.e. self-etch and single bottle system. Ideal bonding agent should be biocompatible, should have adequate bond strength, and should bond to enamel and dentin. Various dentin bonding agents were developed to improve the quality of adhesives and composite restorations.^{3,4} In self-

etching systems, acid etching and primer application processes are combined, and washing process is removed.^{1,5} In one-step self-etch adhesive systems, micro-mechanical retention is still considered the principal mechanism, in which minerals removed from dental hard tissues are replaced by resin monomers that upon polymerization become micro-mechanically interlocked in the created porosities.⁶ The present study was conducted to evaluate the bond strength of self- and total-etch adhesive systems on enamel and dentin before and after contamination with saliva.

MATERIAL AND METHODS:

The present study was carried out on 90 orthodontically extracted premolars with the aim to evaluate the effect

of saliva contamination on the bonding strength of self- and total-etch adhesive systems on enamel and dentin. Adhesive systems used in the study were Self-etch adhesive system (Adper single bond2- 3M) and Total-etch adhesive system (BEAUTIBOND- Shofu). Freshly extracted teeth were washed under running water and scrapped off using an ultrasonic scaler. The teeth were then stored in normal saline at room temperature till further use. Fresh unstimulated saliva was used for the study. Each group was further subdivided randomly into three subgroups of fifteen teeth each depending on the type of contamination subjected to and the steps in the bonding sequence when contamination occurred that was before or after adhesive application. In Self-etch group:

Subgroup I : In this group, the specimens were subjected to contamination with saliva for 15 s using microbrush. After contamination, the surfaces were rinsed and dried for 10 s, and then, the self-etch adhesive was applied. Light curing was done using a curing device for 10 s.

Subgroup II: In this group, the self-etch adhesive was applied to dentin. And then, the surfaces were subjected to contamination with saliva for 15 s and then rinsed and dried as in Subgroup I.

Subgroup III : In this group, the specimens were not subjected to saliva contamination. Self-etch adhesive was applied to dentin of each specimen of group.

In Total-etch group: Subgroup I: In this group, first of all, etchant was applied to the prepared tooth surfaces and left for 15 s. Then, the surface was subjected to contamination with saliva for 15 s using microbrush and then rinsed and dried for 10 s. Immediately after drying, 2–3 consecutive coats of the adhesive were applied for 15 s with gentle agitation using a fully saturated applicator. The adhesive was then light cured for 10 s using a curing device.

Subgroup II: In this group, the total-etch adhesive was applied to dentin. And then, the surfaces were subjected to contamination with saliva for 15 s and then rinsed and dried as in Subgroup I.

Subgroup III: in this group, the specimens were not subjected to saliva contamination. Total-etch adhesive was applied to dentin of each specimen of group.

After the bonding procedure, resin composite was built up in increments of 1 mm using plastic mold. After polymerization, the mold was removed, and specimens were placed at 37°C in distilled water for 24 h before SBS measurement in a universal testing machine at a crosshead speed of 1 mm/min. The collected data were statistically analyzed using two-way ANOVA.

RESULTS:

The result of the study shows that comparison of mean bonding strength of total-etch adhesive which was applied after saliva contamination is less than self-etch adhesive applied after saliva contamination. The bond strength of total-etch adhesive applied before saliva contamination is more than the bond strength of self-etch adhesive applied before saliva contamination. The mean bond strength of total-etch adhesive control is less than self-etch adhesive control group.

Table 1: Grouping of sample

Self-etch group (n=45)	Total-etch group(n=45)
Subgroup I: adhesive application after contamination with saliva (n=15)	Subgroup I: adhesive application after contamination with saliva (n=15)
Subgroup II: adhesive application before contamination with saliva (n=15)	Subgroup II: adhesive application before contamination with saliva (n=15)
Subgroup III: control (n=15) no saliva contamination	Subgroup III: control (n=15)no saliva contamination

Table 2: Comparison of bond strength of both groups before and after contamination with saliva

Groups	Mean ±SD
Total-etch	
Subgroup I	0.97±0.64
Subgroup II	0.93±0.37
Subgroup III	1.05±0.67
Self-etch	
Subgroup I	1.15±0.23
Subgroup II	0.91±0.65
Subgroup III	1.26±0.24

DISCUSSION:

Different mechanical tests such as tensile bond strength and shear bond strength have been proposed to assess the bonding performance of restorative materials. Although it suffers criticism, shear testing has been widely used to evaluate the bonding ability of adhesive materials to dental structure.⁷

Dey *et al*(2016) concluded that the total-etch adhesive systems showed better bond strengths than the self-etch systems in permanent teeth, in all the situations where different contaminants were used.⁸

A study done by Fritz *et al* using a one-step adhesive, which concluded that in a one-bottle adhesive system, any contamination of the already cured adhesive layer seriously compromises the bond strength.⁹

Two-step self-etch adhesive systems have been reported to yield higher bond strengths compared to one-step self-etch adhesive systems, may be due to the proportions of their chemical constituents. Both contain functional monomers, cross-linking monomers, solvent, inhibitors, and activators, but in different proportions. The one-step self-etch adhesive systems generally have less cross-linking monomers. These cross-linking

monomers provide most of the mechanical strength; therefore, there is a potential for lower bond strength, but this is product-specific and may not apply to the recently introduced systems.¹⁰

Chapel RP *et al.* showed that after polymerization, the penetration of resin into lateral canals produced a three-dimensional structure that resembled a network of interconnected adhesive tags. Such an adhesive network may contribute to a strong dentin/ resin bond.¹¹

Andia-Merlin RY *et al.*, found that the monomers of tags and microtags of the three-step adhesive establish intimate contact with dentinal collagen fibrils. The lateral branches or microtags were numerous and profusely penetrated the canalicular system of dentin, establishing an intimate relationship with the mineralized collagen fibrils of intertubular dentin.¹²

CONCLUSION:

Within the limitations of this study we concluded that the self etch adhesives have shown overall better bond strengths compared to total etch adhesives.

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