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Impact of Various Dentinal Drying Methods on the Adhesion of Glass Ionomer Restorations to Primary Teeth

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***Abstract*---**Background: Air drying is considered the most simple and effective method to achieve solvent evaporation. The present study was conducted to assess Impact of various dentinal drying methods on the adhesion of glass ionomer restorations to primary teeth. Materials & Methods: 90 primary teeth of both genders were grounded to a flat dentinal surface. Specimens were randomly divided into three groups. Group I were subjected to air dry, group II to blot dry, and group III to suction dry. Each group comprised of 30 teeth. 10 specimens from each group were dried for 2 seconds, 5 seconds, and 10 seconds. Results: Group I teeth were subjected to air dry, group II to blot dry, and group III to suction dry. Each group comprised of 30 teeth. The mean shear bond strength at 2 seconds, 5 seconds, and 10 seconds in group I was 3.2, 5.4 and 5.3 respectively. The mean bond strength was 2.6. 3.5 and 4.6 in group II and 3.1, 4.2 and 4.0 in group III respectively. The difference was significant (P< 0.05). Conclusion: The maximum shear bond strength of the glass ionomer restoration was observed in the air dry group.

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Keywords---adhesion, air drying, glass ionomer restoration, primary teeth, shear bond strength.

Introduction

Restoring carious teeth is one of the major treatment needs of children. Restorative objectives for children include sealing the cavity, preventing further tooth destruction, rendering the tooth and the tooth–restoration interface caries resistant, and ease of use.[1] Air drying is considered the most simple and effective method to achieve solvent evaporation. However, this effect seems to be dependent on, among other factors, the type of solvent. Ethanol and acetone are common solvents added to adhesive systems.[2] The evaporation process is modulated by solvent vapor pressure, and the combinations of solvents, substrate moisture, monomers, and inhibitors create distinct evaporation rates for different products; therefore, complete solvent elimination by air drying can be difficult to achieve. Consequently, some residual solvent remains trapped in the adhesive.[3]

Glass ionomers are considered to be a leading restorative material as they adhere to the tooth structure, have antibacterial activity and negligible dimensional changes, and release fluoride which produces cariostatic and antimicrobial actions.[4] Glass ionomer cement are water based, and therefore compatible with dentine, which is a water-containing tissue and has a film of odontoblast tubular fluid on the cut surface.[5] Furthermore, manufacturers' instructions concerning the time of air drying necessary to evaporate solvent seems to be insufficient to promote optimal mechanical properties.[6] The present study was conducted to assess Impact of various dentinal drying methods on the adhesion of glass ionomer restorations to primary teeth.

Materials and Methods

The present study comprised of 90 primary teeth of both genders. The consent was obtained from all parents. Data such as name, age, gender etc. was recorded. All primary teeth were grounded to a flat dentinal surface. Specimens were randomly divided into three groups. Group I were subjected to air dry, group II to blot dry, and group III to suction dry. Each group comprised of 30 teeth. 10 specimens from each group were dried for 2 seconds, 5 seconds, and 10 seconds. GC Fuji IX was condensed into Teflon molds, and the specimens were subjected to shear bond strength testing. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table 1
Distribution of teeth

Groups	Group I	Group II	Group III
Method	air dry	blot dry	suction dry
Number	30	30	30

Table 1 shows that group I teeth were subjected to air dry, group II to blot dry, and group III to suction dry. Each group comprised of 30 teeth.

Table 2
Shear bond strength values

Groups	2 seconds	5 seconds	10 seconds	P value
Group I	3.2	5.4	5.3	0.01
Group II	2.6	3.5	4.6	0.03
Group III	3.1	4.2	4.0	0.05

Table 2, graph I shows that mean shear bond strength at 2 seconds, 5 seconds, and 10 seconds in group I was 3.2, 5.4 and 5.3 respectively. The mean bond strength was 2.6. 3.5 and 4.6 in group II and 3.1, 4.2 and 4.0 in group III respectively. The difference was significant (P< 0.05).

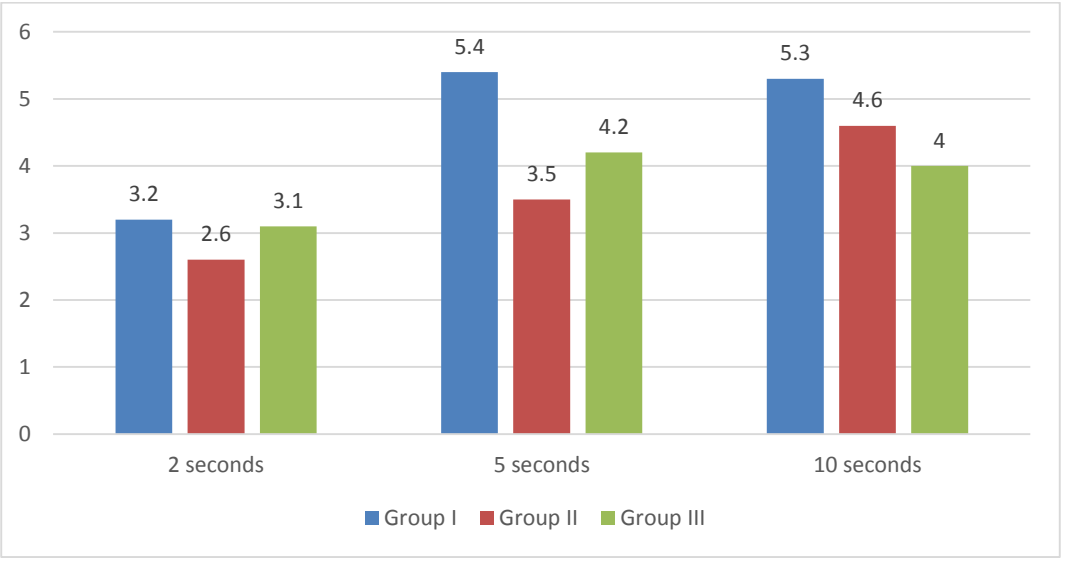

Figure 1. Shear bond strength values

Discussion

Hydrophilic volatile solvents are present in dental adhesive systems to dissolve, ionize, and carry the functional monomers in dentin to create a resin-impregnated collagen matrix known as the hybrid layer.[7] Solvents also serve as a vehicle to remove water from substrate in wet dentin. The presence of residual solvent prior to light curing can not only interfere with the polymerization of adhesive, reducing the degree of conversion, but also reduce the mechanical properties of adhesive layer.[8,9] In addition, residual solvent produces an adhesive layer with a porous structure that enhances water sorption, thereby compromising bonding quality and longevity by hydrolytic degradation.[10,11,12] The present study was conducted to assess effects of different dentinal drying methods on the adhesion of glass ionomer restorations.

We found that mean shear bond strength at 2 seconds, 5 seconds, and 10 seconds in group I was 3.2, 5.4 and 5.3 respectively. The mean bond strength was 2.6. 3.5 and 4.6 in group II and 3.1, 4.2 and 4.0 in group III respectively. Jose et al[13] evaluated the effects of different drying methods for different drying time periods on the shear bond strength of GC Fuji IX to primary tooth dentine. A total of 135 caries-free primary teeth were divided into three groups – air dry, blot dry, and suction dry of 45 specimens each. Of these, 15 specimens each were dried for 2 s, 5 s, and 10 s. The mean shear bond strength values for the different time intervals were analyzed with analysis of variance test. In the air-dry group, the maximum shear bond strength values were obtained when the specimens were dried for 5 s and the least when dried for 2 s (P = 0.00). In the blot-dry and suction-dry groups, the highest values were obtained when the specimens were dried for 10 s and least for 2 s (P = 0.039 and 0.000, respectively).

Werle et al[14] evaluated the effect of air-drying time on degree of solvent evaporation (DE), dentin microtensile bond strength (μTBS), and degree of conversion (DC) of 5 adhesive systems: Adper Single Bond 2, XP Bond, Prime & Bond 2.1, OptiBond Solo, and Adper Easy One. For DE testing, 20 μL of each material was submitted to measurements in a digital balance after an air stream of 3, 5, 10, 20, 30, or 60 seconds; the weight loss was computed and converted to a percentage (DE). For μTBS testing, 50 sound human molars were divided into groups (n = 5). The 5 adhesive systems were applied either in accordance with manufacturers' instructions for solvent drying time (control) or with a prolonged drying time (20-30 seconds). After composite resin was built up on the hybridized surfaces, the teeth were stored for 24 hours and then sectioned to obtain beams that were loaded until fracture. For DC testing, specimens of each adhesive and air-drying condition (n = 3) were evaluated by means of attenuated total reflectance Fourier transform infrared spectroscopy. Prolonged air drying resulted in significantly greater DE than did the time suggested by the manufacturers. The adhesives XP Bond and Adper Easy One showed significantly greater μTBS with prolonged air drying. The DC was not affected by airdrying time. No statistically significant correlation was found between DC and μTBS values. Depending on the material, bond strength can be improved by prolonged air-drying times.

Even though thorough air drying results in collapsed collagen matrix and precludes optimal resin infiltration, it is not as detrimental as the deficient solvent evaporation that would result from short or insufficient air drying.[15] Suction drying, which seems much less vigorous, might better prevent the collapse of the collagen matrix.[16] The slightly lower (but not significantly different) bond strength values and decreased percentage of cohesive substrate failures observed with suction drying may be attributed to the fact that the suction tip might not have delivered enough negative pressure in order to prevent the accumulation of residual water or other solvents.[17,18]

Conclusion

Authors found that the maximum shear bond strength of the glass ionomer restoration was observed in the air-dry group.

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