

CONVERSION OF A ONE-STEP SELF-ETCH ADHESIVE INTO A TWO-STEP SELF-ETCH ADHESIVE: SIX-MONTHS CLINICAL RESULTS IN NON-CARIOUS CERVICAL LESIONS

ABSTRACT

PURPOSE: The purpose of this randomized controlled clinical trial was to evaluate the clinical performance of a one-step self-etch adhesive system in non-cariou cervical lesions with and without the application of an additional hydrophobic resin coat. **MATERIALS AND METHODS:** Sixty-four non-cariou cervical lesions were selected and randomly assigned to one of the two bonding technique: 1) a one-step self-etch adhesive (Adper Easy Bond, 3M ESPE) was applied following manufacturer's instructions; 2) a hydrophobic resin coat (Scotchbond Multipurpose Bonding Agent, 3M ESPE) was applied over the uncured Adper Easy Bond adhesive. All lessons were restored using a microhybrid composite resin (Filtek Z250, 3M ESPE). Clinical effectiveness was recorded at baseline and after 6-months of clinical service. **RESULTS:** Two restorations of each group debonded after a 6-months period. The overall clinical success was 93.8%, and no statistical significant differences could be detected for all evaluated criteria within this period. **CONCLUSION:** The applications of a hydrophobic resin coat over Easy Bond did not increase bonding effectiveness over a 6-months period.

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INTRODUCTION

One-step self-etch adhesives are produced from a complex blend of hydrophilic and hydrophobic monomers, solvents and water, combining etching, priming and bonding application steps into one-bottle solution.¹

When a one-step self-etch adhesive is applied on dentin will attract water from the dentin surface into the adhesive during gelation phase, travelling through channels to bind to polar groups of hydrophilic and ionic monomers via hydrogen bonding and van der Waal's forces.² The high water affinity of this class of adhesive can bring negative consequences to interfacial sealing and bond strength to dentin as water tend to accumulate on the surface of the hybrid layer,³ inhibit copolymerization inside the adhesive⁴ and expedite polymer softening⁵ and degradation.^{6,7}

During the past few years the undermine effect of self-etch adhesives hydrophilicity on bonding efficacy to dentin has been extensively reported.^{8,9,10,11,12}

The clinical performance of one-step self-etch adhesive systems has inferior long-term retention when compared two- or three-step systems.¹³ The application of a layer of hydrophobic resin over one-step self-etch adhesives has been suggested as an alternative procedure to prevent thoroughgoing water sorption.¹⁴

This way, the purpose of this study was to evaluate the clinical performance of a one-step self-etch adhesive in non-carious cervical lesions with and without the application of an additional hydrophobic resin layer.

MATERIAL AND METHODS

After signed an informed consent under a protocol approved by the Ethics Committee of the Federal University of Santa Catarina, School of Dentistry, 17 patients were selected for this study. Sixty-four non-carious cervical lesions in buccal surfaces of the teeth were selected and restored.

1. EXPERIMENTAL DESIGN AND RESTORATIVE PROCEDURES

Each patient received the same numbers o restorations of both adhesive techniques used. Before the adhesive procedures the teeth were cleaned and the field isolation was accomplished by using a labial retractor, cotton rolls, saliva aspirator, and a retraction cord.

The bonding procedures were performed following one of the two experimental adhesive techniques: in the control group, the lessons were restored using the one-step self-etch adhesive system Adper Easy Bond (3M ESPE, St. Paul, MN, USA) according to the manufacturer's instructions; in the experimental group, an additional

hydrophobic adhesive layer (Scotchbond Multi Purpose, Bonding Agent, 3M ESPE) was applied over the unpolymerized one-step self-etch adhesive. After the bonding procedures the lesions were restored using a microhybrid composite resin (Filtek Z250, 3M ESPE) in 2 or 3 incremental increments.

2. EVALUATION PROCEDURE

Two calibrated evaluators assessed the restorations at baseline (1 day after restorations placement) and after 6 months¹⁵ in terms of retention, post-operative sensitivity, marginal discoloration in enamel and in dentin, marginal integrity in enamel, marginal integrity in dentin, recurrent caries, periodontal health, and pulpal vitality.

The data were analyzed using Fisher's exact and McNemar tests, for each criteria evaluated. For all statistical analyzes a 5% significance level was adopted ($\alpha=0.05$).

RESULTS

All restorations were examined at 6-month follow-up (recall rate 100%). The retention rate was 93.8% for both groups because two restorations per group debonded. The four debonded restorations were from different patients indicating a low influence of patient factor. For marginal integrity criteria, one restoration from the experimental group showed Bravo score in enamel. In dentin, two

restorations from control group and one restoration from experimental group were assigned with Bravo rating.

All restorations received Alfa score for all the other criteria evaluated. So, no statistical differences could be detected. The recall results are summarized in Table 1.

Table 1. Summary of direct evaluations after a 6-months period.

| Criterion | Recall period | | | |
|---|---------------|------|----------|------|
| | Baseline | | 6 months | |
| | EB | EB+B | EB | EB+B |
| Recall rate | 100 | 100 | 100 | 100 |
| Retention rate | 100 | 100 | 93.8 | 93.8 |
| Spontaneous sensitivity | 0 | 0 | 0 | 0 |
| Provoked sensitivity | 0 | 0 | 0 | 0 |
| Marginal discoloration in enamel | 0 | 0 | 0 | 0 |
| Marginal discoloration in dentin | 0 | 0 | 0 | 0 |
| Marginal integrity in enamel | 100 | 100 | 100 | 96.6 |
| Marginal integrity in dentin | 100 | 100 | 93.3 | 96.6 |
| Absence of caries occurrence | 100 | 100 | 100 | 100 |
| Periodontal health | 100 | 100 | 100 | 100 |
| Pulpal vitality | 100 | 100 | 100 | 100 |
| Overall clinical success rate | 100 | 100 | 93.8 | 93.8 |
| Percentages of all parameters evaluated refer to retained restorations, except for recall rate, retention rate and overall clinical success rate. | | | | |

DISCUSSION

The purpose of this study was to evaluate clinically the long-term effect of an additional coat of hydrophobic resin over a one-step self-etch adhesive trying to overcome the vulnerability of these adhesive systems to

degradation. To really assess the bonding efficacy to dentin of either bonding techniques used, no bevel or selective enamel etching were performed.

The low etching ability of self-etch adhesive systems to unground enamel can compromise the establishment of micromechanical retention and marginal sealing.¹⁶ Retention of such poor-bonded non-cariious cervical composite restorations to the enamel margin would then rely mainly on dentin bond quality. This was made consciously to minimize the influence of enamel bonding on the retention. As a result one should expect significant decrease in enamel marginal discoloration and enamel marginal integrity rates. The excellent results for the enamel margins may, however, be a matter of time. In a randomized clinical trial evaluating the effect of selective enamel etching prior to the application of a mild self-etch system, unfavorable results for marginal integrity and discoloration were obtained for the non-etched group already at 2 years.¹⁷

The adhesive system used in this study was recently introduced and no literature is yet available about it apart from a few meeting abstracts. Its composition reveals no major differences from other tested HEMA-containing one-step self-etching systems, and so it would be reasonable to hypothesize that Adper Easy Bond would also be subjected to water sorption and the consequences arising

from this phenomenon. At 6-month follow-up it is not possible to affirm either that Easy Bond is resistant to water sorption and degradation or that the application of an additional coat of hydrophobic resin increases bond durability of Adper Easy Bond to dentin since two restorations were lost from each group.

Degradation of resin-dentin bonds in vitro by water storage has been observed as soon as 3 months,¹⁸ 6 months¹⁹ and 1 year^{10, 19, 20} for one-step self-etch adhesives, while for two-step self-etch systems dentin bond durability have been shown to be affected after 6 months,²¹ 1 year^{18, 19, 22} and 3 years.²⁰ In vivo preservation of bond strength have also been demonstrated for another two-step self-etch adhesive after 1 year of clinical service.²³ Furthermore, little uptake of silver nitrate as a reflection of water diffusion has been observed for two two-step self-etch systems after 6 months, whereas after 3 months a one-step self-etch adhesive had already shown severe signs of water sorption in comparison to 24 h.²⁴

These reports indicated a possible beneficial role of an impermeable layer of hydrophobic resin over a rather permeable one on dentin bond. When one-step self-etch adhesives were actually converted into two-step self-etch systems by the application of an additional coat of hydrophobic layer, this beneficial role was ratified by increasing bond

strength and reducing signs of water uptake.^{25, 26, 27} Along with diminishing interface permeability, thickening the adhesive layer has also shown to bring advantages to dentin bonding.^{28, 29}

Finally, from the results of this clinical trial, which showed 93.8% of retention after 6-months for both groups, Easy Bond cannot be said to fulfill the provisional ADA acceptance guidelines for dental adhesives, which recommends a minimum of 95% retention rates after a six-months period.

CONCLUSION

The applications of a hydrophobic resin coat over the one-step self-etch adhesive tested do not increase bonding effectiveness over a 6-months period.

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