Clinical Bonding of a Single-step Self-etching Adhesive in Noncarious Cervical Lesions

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Purpose: The aim of this study was to evaluate the clinical retention to dentin of a single-step self-etching adhesive system.

Materials and Methods: A total of 133 Class V restorations were placed with the self-etching primer Xeno III and a resin composite (Tetric Ceram) or a polyacid-modified resin composite (Dyract AP) in noncarious cervical lesions without intentional enamel involvement. The restorations were evaluated at baseline and then every 6 months during a 2-year follow-up. Dentin bonding efficacy was determined by the percentage of lost restorations.

Results: During the 2 years, 130 restorations could be evaluated. The cumulative loss rate at 2 years was 7.7%, with no significant differences between the two restorative materials. The self-etching adhesive fulfilled the 18-month full acceptance ADA criteria.

Conclusion: The single-step self-etching adhesive showed acceptable clinical retention rates to dentin surfaces during the evaluation period independent of restorative material used.

Keywords: adhesion, clinical, cervical, dental material, etch, resin, restoration, self-etching.


Purpose: The introduction of primers containing amphiphilic monomers – dissolved in solvents such as water, acetone, or alcohol to promote wetting of the dentin and replace water – changed dentin bonding to a more reliable clinical procedure. These primers infiltrate the nanospaces of the collagen network, caused by the etching procedure, and create after polymerization an entangled molecular mesh with the collagen fibrils. A high micromechanical bond to the dental tissue can be obtained by formation of the so-called hybrid layer. In the multistep etch-and-rinse systems, clinical success is partly operator related. The etching and primer application steps are critical in this approach. Bonding procedures not involving phosphoric acid etching, such as the self-etching adhesives, were introduced in the 90s to simplify the adhesive procedure and decrease the technique sensitivity of the etch-and-rinse systems. The simultaneous self-etching and primer infiltration makes these systems more user friendly, eliminating the risk of over etching and over drying. Today, there are two self-etching systems. The two-step self-etching adhesives have a separate priming step with more hydrophilic monomers and a more hydrophobic bonding step. In the all-in-one or one-step self-etching adhesives, one liquid containing all the components for etching, priming, and bonding is applied to the dental tissues. Earlier mild self-etching adhesives showed etching patterns of the enamel which were not adequate for clinical retention, and some manufacturers recommended the adjunctive use of phosphoric acid when bonding to enamel. Incompatibility with autocuring resin composites and permeability to water movement after polymerization have been reported for the first all-in-one adhesives. Newer self-etching adhesives contain more aggressive etchants and showed higher tensile bond strength compared to established dentin bonding agents. The aim of this study was to investigate the clinical dentin bonding effectiveness of a new one-step self-etching adhesive in combination with a resin composite material or a polyacid resin-modified resin composite in noncarious cer-
vical lesions. The hypothesis tested was that the polycrystalline resin-modified resin composite would show better clinical retention.

MATERIALS AND METHODS

A total of 133 Class V restorations were placed in 57 patients (32 men and 25 women) with a mean age of 61.5 years (range 43 to 84), for whom treatment of noncarious cervical lesions was indicated. All restorations were placed in dentinal lesions without any intentional enamel involvement, by one experienced operator familiar with adhesive dentistry. Forty-four restorations were placed in anterior teeth, 55 in premolars and 32 in molars. Fifty-nine restorations were made in the maxillary arch and 74 in the mandibular. A single-step self-etching primer (Xeno III, Dentsply/DeTrey; Konstanz, Germany; lot nr 0206001237) was evaluated in combination with two different restorative resinous materials, a hybrid resin composite (Tetric Ceram, Ivoclar/Vivadent; Schaan, Liechtenstein; lot E17820) and a polycrystalline-modified resin composite (Dyract AP, Dentsply/DeTrey; batch nr 0203001190). Liquid A of the two-part adhesive system contains water, ethanol, HEMA, UDMA, and BHT (2,6-di-tert-butyl-p-hydroxytoluene) and nanofiller. Liquid B contains UDMA, CQ, EPD (p-dimethylaminomethyl benzoxoate) and two patented monomers Pyro-EMA (tetramethacryloyxethyl pyrophosphate and PEM-F (pentamethacryloyxethyl cyclophosphazene monofluoride).

The operative field was isolated with cotton rolls and a saliva suction device. Before conditioning, the lesions were cleaned of plaque and/or saliva if necessary. The adjacent gingiva was retracted by gingival retraction instruments or matrix bands when necessary to secure unrestricted contamination-free access to the field. No bevel was placed. Application of the primer was performed according to the manufacturer’s instructions. After mixing, the primer was applied for 20 s, carefully air dried for some seconds to remove the solvent, taking care not to thin the primer layer. The layer was then light cured for at least 10 s (Astralis 7, HP curing mode; Ivoclar/Vivadent). Sixty-five restorations were made at random with the polycrystalline-modified resin composite and 68 with a high-viscosity resin composite restorative material. The restoratives were applied in most cases in two increments using selected composite instruments (Hu Friedy; Leimen, Germany) and light cured. All participants were informed about the material and the follow-up evaluations according to the rules at the Dental School Umeå. The restorations were evaluated at 6, 12, 18, and 24 months using slightly modified USPHS criteria. Only the retention and secondary caries evaluations are reported here. Postoperative hypersensitivity was registered. Descriptive statistics were used to present the results. Cumulative retention failures were calculated by dividing the number of lost restorations at the recalls by the total number evaluated at the respective recall. Differences in distribution of the ratings between the adhesive systems for the investigated variables were statistically analyzed with the binomial test for independent samples and intrindividual comparisons of the 2 materials with Friedman’s two-way analysis of variance.

RESULTS

At the end of the follow-up, 130 restorations could be evaluated. One patient with three restorations was not able to attend the 2-year recall. No recurrent caries was observed or postoperative hypersensitivity reported. Ten lost restorations (7.7%) were observed during the 2-year follow-up, resulting in relative cumulative failure frequencies for all restorations at 6, 12, 18, and 24 months of 0.8%, 3.1%, 6.9%, and 7.7%, respectively. The failure frequencies for the restorations with Tetric Ceram at the four evaluations were 0%, 0%, 5.9%, and 7.4%, and for Dyract AP restorations 1.6%, 6.5%, 8.1%, and 8.1%, respectively; the differences were not statistically significant (Fig 1).
DISCUSSION

The rapid progression of adhesive materials during the last 20 years has resulted in a situation where many adhesive systems have been replaced by modified successors which were claimed to be better without clinical validation. Clinical trials have been limited in number since they require several years of regular recalls. Enamel-resin bonds produced after acid etching with phosphoric acid have proven satisfactory and stable over time. Adhesion to dentin, on the other hand, has been difficult to achieve because of the substrate’s wet nature. The efficacy of dentin bonding can be demonstrated in cervical abrasion/erosion lesions without involvement of the contiguous enamel. These surfaces are ideal to test clinical dentin bonding because they are widely available. Therefore, no enamel bevel was made in the study and care was taken not to involve the enamel surface contiguous with the lesions during the etching-priming step. However, many of the lesions still contained a small enamel margin in the incisal area, and the evaluation of clinical retention to only dentin tissue was therefore not 100%. At the end of the two years, the recall rate was high (130/133). The retention rate for the adhesive system was 92.3%. Tüürkün recently reported a 96% retention rate after one year for the same adhesive. For provisional acceptance, the latest guidelines of the American Dental Association (Dental and enamel adhesive materials: ADA, Council on Dental Materials, Instruments, and Equipment, 1994) for submission of dentin and enamel adhesive materials require that no more than 5% of the restorations have been lost and not more than 5% of the restorations may show microleakage at the 6-month recall. To obtain full acceptance, the cumulative incidence of clinical failures in each of two independent clinical studies has to be lower than 10% lost restorations and 10% microleakage after 18 months. The dentin retention rates for the tested adhesive were 3.1% and 6.9% at 6 and 18 months, respectively, fulfilling the ADA guidelines for enamel-dentin adhesive systems. There were no significant differences in clinical retention rates between the restorations placed with the resin composite or the polyacid-modified resin composite. The hypothesis was therefore not accepted. Kemp-Scholte et al. showed that materials with lower elasticity modulus can act as an elastic buffer, which relieved contraction stresses and improved marginal integrity. Since most polyacid-modified resin composites include resins with a modulus of elasticity value between those of resin composite and glass-ionomer cement, these materials may work as a stress-breaking barrier between the tooth and the composite. A significantly better adaptation was observed with the SEM replica technique for a polyacid-modified resin composite/resin composite sandwich technique compared to resin composite only restorations. However, the same authors could not show any clinical evidence for the interfacial adaptation results observed by SEM. No significant statistical or clinical differences were observed between the two techniques during 3- and 9-year periods. The polyacid-modified resin composite tested in the present study has a modulus of elasticity value close to that of resin composite materials, which may partly explain why no differences were observed (personal communication, E. Assummen).

CONCLUSION

It can be concluded that the single-step self-etching adhesive showed acceptable clinical retention rates during the evaluation period, independent of restorative material used.

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REFERENCES


Clinical relevance: The adhesive showed a good clinical performance during the 2 year follow-up in noncarious cervical lesions.