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Original Article

Clinical Evaluation of a Self-Etch and an Etch-and-Rinse Adhesive System in Class V Noncarious Composite Restorations

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Abstract

Context: Adhesive restorations in cervical, noncarious, and nonretentive cavities are used as a clinical model for the evaluation of adhesive systems. **Aim:** The aim of this study is to evaluate restorations made by dental students of the last year of dentistry made with a self-etching and etching-and-rinse adhesive system. **Materials and Methods:** Eighty-two noncarious cervical lesions Class V cavities were restored after randomly be allocated into two adhesive groups: self-etch (AdheSe self-etch) or an etch-and-rinse (Tetric N-Bond). Operators were two well-trained students of the last year of dental school and the restorations were evaluated using a single examiner, specialist in restorative dentistry, blinded and calibrated using the criteria according to the modified United States Public Health Service. Descriptive analysis, Chi-square test to evaluate associations, and survival analysis by the Kaplan–Meier were used for statistical analysis. **Results:** There was no statistically significant difference in the evaluation of adhesive systems in Class V restorations ($P = 0.160$). There was also no statistically difference ($P = 0.751$) in the assessment of the existence of occlusal interference on lateral movement and loss of restorations. The survival rate calculated for the total restorations was 89%. The survival rate of the restorations when used etch-and-rinse adhesive systems was 92.7% while with the self-etching of 85.4%. Nine restorations were classified as lost, and one restoration cannot be assessed due to the patient having it replaced before evaluation, and the other eight restorations were lost getting the score Charlie for retention. **Conclusions:** Class V dental restorations had a satisfactory survival rate irrespective of the adhesive system.

Keywords: Adhesive system, randomized clinical trial, restoration, survival, United States Public Health Service

Introduction

Noncarious cervical lesions (NCCLs) are characterized by the loss of tooth structure in the cervical region of the tooth without bacterial involvement, also known as tooth wear, which may be initiated by erosion, abrasion, abfraction or may have a multifactorial origin.[1-3] After identify and treat the etiological factor, sometimes restorations are necessary to protect the remaining dental structure, decrease mineral loss and hypersensitivity and finally, reduce plaque accumulation.[1,4]

Adhesive restorations in cervical, noncarious, and nonretentive cavities are used as a clinical model for the evaluation of adhesive systems, as recommended by the American Dental Association.[5] This is because cervical lesions do not have macro mechanical retentions and because they are widely available in patients with better hygiene habits than the average.[6] These lesions require at least 50% of adhesion in dentin and are usually found on anterior teeth and premolars with good access for restoration. An inefficient adhesion usually results in loss of restoration, considered the better clinical parameter used by clinical studies.[7]

Usually, there is two strategies for the use of adhesive systems: to totally remove the smear layer with the previous acidic conditioning followed by the application of a primer and an

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adhesive applied in one or two stages or partially remove or modify the smear layer through self-etching adhesive systems which may be combined acid and primer or with all components combined in a single step.[8] Currently, the use of self-etch adhesive system in NCCL restorations has been increased[9] and due to scarce number of studies comparing these adhesive systems in restorations performed by dental students, the objective of this study is to evaluate the clinical behavior of these restorations made by students in the last year of the dental school.

Materials and Methods

Design

This was a parallel, double-blind, randomized clinical trial aiming to compare the survival rate of restorations performed by dental students using two different adhesive systems. The project was approved by the Institution's Ethics and Research Committee with protocol number 307.2010.2, and was in accordance with the World Medical Association Declaration of Helsinki. The restorations were carried out using two-trained dental students from the Franciscan University (UFN), Santa Maria, RS, Brazil. One experienced dentist evaluated the restorations according to the modified United States Public Health Service (USPHS). Descriptive analysis, Chi-square test to evaluate associations, and survival analysis using the Kaplan–Meier were used for statistical analysis. The report is based on the CONSORT statement.[10]

Eligibility

The eligibility criteria to participate in the study were patients with at least 18 years old who presented:

- Anterior or posterior permanent teeth with NCCLs
- Teeth with pulp vitality
- Teeth with restorative need
- At least two similar or defective restorations requiring replacement
- Had received adequate oral care
- Signed a free and informed consent form.

It is important to emphasize that no bevel was made for the preparation of the restorations, and all the patients received guidelines for the removal of the etiological factor irrespective of which they were. If necessary, a referral to another professional was made, depending on the case complexity.

Randomization

The patients were randomly selected according to the restorative need, obeying the eligibility criteria. The teeth were randomly assigned to be restored a self-etching adhesive system (AdheSE self-etch, Ivoclar Vivadent, Schaan, Liechtenstein) (SE) or an etching-and-rinse adhesive system (Tetric-N Bond, Ivoclar Vivadent, Schaan, Liechtenstein) (ER). The randomization was performed by first selecting the adhesive system to be used by drawing with a coin, and then the first tooth to be restored was defined, which was the least numbered tooth. The second adhesive system was used on the remaining tooth. A minimum of two restorations per patient was performed, an even number for each individual, aiming at correct randomization. The restorations were carried out by two dental students from the UFN, Santa Maria, RS, Brazil, who followed the manufacturer's protocol for each restoration, presented in Table 1. The numbers of restorations included were based in previous studies.[11,12]

Clinical protocol

For the clinical procedure, modified relative isolation with a retractor wire 000 Ultrapack (Ultradent, South Jordan, Utah, USA), labial retractor (Indusbello, Londrina, PR, BR), cotton rollers and sucker. The restorations were performed with composite resin (Tetric-N Ceram, Ivoclar Vivadent, Schaan, Liechtenstein). The finishing of the restorations was done with diamond bur 3195F (KG Sorensen, São Paulo, SP, Brazil) and polishing with Praxis disc (TDV, Pomerode, SC, Brazil), polishing rubbers DFL (DFL, Rio de Janeiro, RJ, Brazil) and felt discs (Flexi Diamond Flex, FGM, Joinville, SC, Brazil) and diamond paste (Diamond Excel, FGM, Joinville, SC, Brazil).

Calibration

Only one experienced examiner and specialist in operative dentistry were calibrated to perform the evaluation of the restorations. The calibration process was made in two steps. First, the examiner evaluated Class V restorations of patients who were not part of the study, approximately 10% of the sample, according to the USPHS criteria. The data found by the examiner were cataloged in a way that the examiner

Table 1: Materials and adhesive procedures used in the present study

Material	Composition	Manufacturer	Application procedures
AdheSE self-etch AdheSE primer AdheSE bond	AdheSE primer: Phosphonic acid acrylate, bis-acrylamide, water, initiators and stabilizers AdheSE bond: Dimethacrylates, bis-GMA, HEMA, Si-dioxide, initiators and stabilizers	Ivoclar Vivadent, Schaan/ Liechtenstein	Applying friction 30 s Smooth air drying 5 s Bond application and photocure 20 s
Tetric N-bond	Phosphoric acid acrylate, HEMA, bis-GMA, urethane dimethacrylate, ethanol, film-forming agent, catalysts and stabilizers	Ivoclar Vivadent, Schaan/ Liechtenstein	37% phosphoric acid gel application 30 s enamel and 15 s dentin Rinsing with air-water spray for 30 s Drying with water-absorbent paper and smooth air drying Bond application and photocure 20 s

Bis-GMA – Bisphenol A-glycidyl dimethacrylate, HEMA – Hydroxyethyl methacrylate

did not have access. The second stage was performed 1 week later with the examiner repeating the evaluation of the same restorations without, however, having access to the results obtained during the first examination. After the analyzes, the data between the initial evaluation and the second evaluation were compared and calculated. From this mean, a reproducibility coefficient (Kappa) of K = 1 was obtained for the calibration of the examiner for the USPHS criteria.

Clinical evaluation

The examiner evaluated the restorations with the use of mirror and exploratory probe regarding the criteria developed by Cyar and Ryge,[13] the modified USPHS and was blind to the type of adhesive system used. The parameters evaluated were: color stability, marginal discoloration, anatomical shape, marginal integrity, and secondary caries lesion. For each criterion, an Alpha (higher degree of clinical acceptability), Bravo, Charlie, and Delta scores (progressively lower degrees of clinical acceptability) were used. For the periodontal examination, visual inspection was performed to determine the visible plaque index (VPI), and the periodontal probe was used to evaluate the marginal bleeding index (MBI) of the restored and control teeth. The teeth used as a control were preferentially adjacent or as close as possible to the restored teeth; however, the control teeth could not present cervical restoration. An occlusal analysis was also carried out regarding the presence of occlusal interference in lateral movement in the restored teeth.

Statistical analysis

The statistical software SPSS 22 for MAC (SPSS Inc., Chicago, IL, USA) was used. Frequency analysis was performed for the scores obtained in each evaluated criteria by the USPHS and plaque and gingival indexes of the restored teeth and control. Chi-square test, at a significance level of 5% (α = 0.05) to evaluate the existence of an association between restoration survival with tooth type and occlusal interference was also performed. The survival analysis was evaluated by the Kaplan–Meier test, and Log-rank was performed to evaluate the existence of a difference between the adhesives tested.

Results

Eighty-two restorations (or 41 pairs) were performed in 14 patients (3 males [21.42%] and 11 females [78.58%]), with a mean age of 50.9 ± 8.7 years. From the 82 restorations performed, 54 (65.9%) were reevaluated within a mean time of 563.48 ± 268.08 days or approximately 18 months. The distribution of the restorations performed by teeth, arch, and adhesive system used is presented in Table 2.

One restoration could not be evaluated because the patient had previously replaced it. In addition, eight restorations received Charlie's score for the retention criteria, also being considered as lost restoration. The other restorations received Alpha score in these criteria. For color stability, marginal discoloration, anatomical shape, marginal integrity, and secondary caries, all the restorations evaluated presented Alpha or Bravo score. The percentages of negative VPI and MBI of restored teeth were 91.8% for both indices and for adjacent teeth, 93.4% and 96.7%, respectively.

The obtained results in the Chi-square test for association between restoration survival and restored tooth type and the association between restoration survival and occlusal interference in restored teeth are presented in Table 3.

Table 2: Number of restored teeth by group, arch and adhesive system used

Arch	Tooth	Adhesive system	
		SE	ER
Upper jaw	Central incisor	0	1
	Lateral incisor	1	1
	Canine	3	4
	Premolar	15	17
	Molar	4	4
Lower jaw	Central incisor	2	2
	Lateral incisor	1	2
	Canine	1	0
	Premolar	12	9
	Molar	2	1

SE – Self-etching, ER – Etching-and-rinse

Table 3: Association between restoration survival and tooth type and occlusal interference in lateral movement (α=0.05)

	Survived	Lost	*P*
Tooth type			0.002
Upper-front teeth	10	0	
Lower-front teeth	8	0	
Upper-posterior teeth	39	1	
Lower-posterior teeth	16	8	
Occlusal interference			
Yes	41	6	0.751
No	26	3	

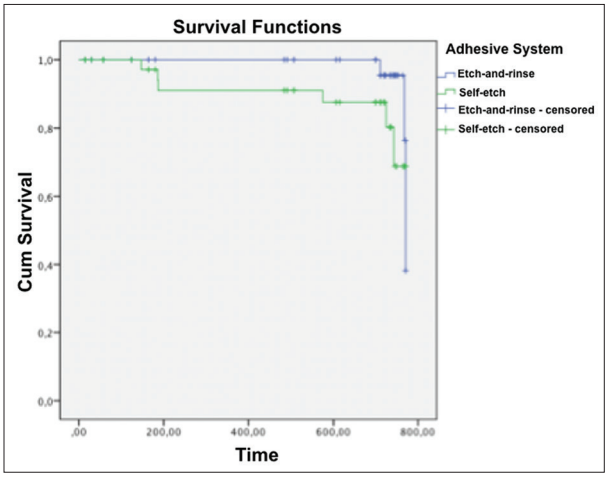

Figure 1: Kaplan–Meier graphs showing the survival according to the type of adhesive system (log-rank test, *P* = 0.160)

The calculated survival rate was 89%. The restorations performed with etch-and-rinse adhesive system had a survival rate of 92.7%, whereas self-etching adhesive system presented a survival rate of 85.4% ($P = 0.160$, according to Log-rank test). These results are presented in Figure 1.

Discussion

Since the '90s, adhesive technology has progressed rapidly, and lots of adhesive systems were often replaced by a successor, which was indicated to be better, however, usually without or with reduced clinical validation. To test adhesive materials, laboratory studies attempt to simulate clinical conditions and are essential for several properties, but sometimes, do not reflect the actual clinical performance of adhesive systems. Therefore, clinical trials are recommended.[9,11]

Class V restorations are usually chosen for clinical evaluation of adhesive systems because they do not promote mechanical retention and normally the patients present better hygiene habits than general population, which is in an agreement with the percentage of negative VPI and MBI (91.8% for both indices) in evaluated and restored teeth in the present study. These Class V lesions are usually found on anterior and premolar teeth and require retention of at least 50% in dentin because they have a thin layer of enamel.[5]

In the present study, the restorations evaluated according to the USPHS criteria showed a survival percentage of 89%, being 85.4% for the SE and 92.7% for ER adhesive system, showing no significant difference between groups. If only marginal adaptation is taken into account, no difference between adhesive systems was found, which is not in accordance with Peumans *et al*.[12] that evaluated for 5 years a two steps SE and one ER. At the end of the study, it was possible to observe a better marginal adaptation in the acid conditioned group; however, for retention, no significant difference was found. It is important to emphasize that the 18-month period is relatively short when compared to the 5 years. Similar to our study, Türkün[14] evaluated 98 restorations performed with Clearfil SE Bond and Prime and Bond NT adhesive systems for 6, 12, and 24 months. After 2 years of evaluation, the survival rates of the restorations evaluated were 93% for the Clearfil SE Bond adhesive and 91% for the Prime and Bond NT adhesive. Van Dijken,[15] through a randomized clinical trial evaluated 112 Class V restorations using an SE and ER adhesive system. After 8 years, the loss of restorations was 25.5% and 39.3%, respectively. Regarding the survival rates after 18 months, the ER presented 90.6% and the SE 98.2%. Interesting, for both studies, the SE adhesive systems presented better survival rates, which was not observed in our study. A possible explanation for this may be due to the restorations been performed by dental students, which usually used ER during the graduation, and although they were trained for SE adhesive system, was the first contact with this strategy.

Studies[16-19] have been suggested etching the enamel with 35% phosphoric acid to improve the bond strength of SE. It was tested in a clinical trial[20] and lower percentage of marginal discoloration was found for this group when compared with no acid etching. Another way to improve the performance of SE is to apply the primer twice the time recommended by the manufacturer. In the present study, none of the strategies above were applied since the manufacturer's instructions do not indicate these additional operative steps. This, associated with the low experience of the operators with this adhesive system, would be a bias for the study.

A characteristic usually found in NCCL is sclerotic dentin. Some authors recommended the removal of the superficial surface of the sclerotic dentin using diamond burs, its increases surface energy, improving the adhesion, and create a more homogeneous hybrid layer.[21] In the current study, neither roughness was performed before the procedure nor any other form of retention was performed; thus, the retention of restorations was exclusively at the expense of the adhesive material used.

The success and longevity of the restorations are dependent on the quality of the material used, the operator, and the individual needs of each patient.[22] For the clinicians, the essential is restorative knowledge, both technical and theoretical. The results obtained will certainly be better with a further improvement of the technique to minimize errors and ensure success for restorations. A correct selection of the material to be used should be made, depending on the location and length of the preparation, as well as the correct color selection, performing the restoration as natural as possible.

The restorations that received Alpha or Bravo scores were considered as survival since the USPHS criteria can be dichotomized, with Alpha and Bravo scores considered success and Charlie and Delta as loss of restoration. This implies that discrete alterations in the score of restoration from Alpha to Bravo in any of the evaluated criteria have no significant clinical implications. On the other hand, a statistically significant difference was found for tooth type, with more losses in lower/posterior teeth. Considering that the existence of occlusal interference is not a relevant factor for the survival of Class V restorations, it seems that the technical difficulty of restoring lower/posterior teeth is higher, in which the contamination control during the procedures is increased. Thus, special care must be taken to perform this type of restoration in this type of tooth when using cotton rolls instead of rubber dam in the operative field.

The high general survival rate observed for restorations performed by dental students indicates good performance of materials and techniques used for this study; however, it is suggested long-term evaluation of restorations.

Conclusions

- The restorations had an acceptable survival rate, irrespective of the evaluated group
- There is no influence of occlusal interference in the lateral movement for restoration success; however, tooth type

can interfere in survival rates of Class V restorations performed by dental students.

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Conflicts of interest

There are no conflicts of interest.

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