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Influence of chlorhexidine digluconate on the clinical performance of adhesive restorations: A 3-year follow-up

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ABSTRACT

Objectives: The aim of this clinical study was to evaluate the long-term clinical performance of non-carious Class V restorations with and without application of chlorhexidine digluconate to acid-etched dentine.

Methods: After the approval of the Ethics and Informed Consent Committee, 70 non-carious cervical lesions were selected and randomly assigned into two groups, according to the split mouth design. The control group was restored with a two-step etch-and-rinse adhesive (Adper Single Bond 2) following manufacturer's instructions; whereas in the experimental group 2% chlorhexidine digluconate solution was applied to acid etched dentine for 30 s after etching and prior to the adhesive application. All lesions were restored with a nanofilled composite resin (Filtek Supreme XT) and polymerized with a light-curing unit operating at 600 mW/cm^2. Clinical performance was recorded after 1 week, 6, 12, and 36 months using modified Ryge/USPHS criteria in terms of retention, marginal discoloration, marginal integrity, post-operative sensitivity, and secondary caries incidence. Data were analyzed using Chi-Square, Fisher's exact test and McNemar tests (α = .05).

Results: After 36 months the control group showed a success rate of 88% in comparison to 76% of experimental group; however, no statistically difference between them was found (p = .463). Moreover, no statistical differences were observed between groups in the criteria post-operative sensitivity, marginal discoloration, marginal integrity, and secondary caries incidence between the two groups.

Conclusion: The addition of 2% chlorhexidine digluconate conditioning step does not improve the clinical durability of adhesive restorations.

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1. Introduction

Since enamel etching technique introduction, by Buonocore in 1955, the adhesive systems have been extensively developed.[1] The adhesion to the tooth tissues is normally based on replacement of the tooth minerals, removed with acid-etching, by resin monomers with low viscosity.[2,3] The heterogeneous composition of dentine tissue, its hydrophilicity, low surface energy, variable permeability and the presence of a smear layer, make the dentine a challenging substrate to bond a resin composite restoration.[1] Bonding to dentine has become trustworthier since the introduction of hydrophilic adhesive systems, which can infiltrate into the wet dentine substrate, although bonding exclusively to dentine has shown not to be as durable as expected when hydrophilic adhesive systems are used.[1]

Several studies have been investigating the factors responsible for the low durability of the resin–dentine bonds with hydrophilic adhesives. One reason for this poor performance is the slow hydrolysis of unprotected collagen fibrils within and under the hybrid layer by host-derived enzymes in incomplete resin-infiltrated zones of resin-bonded dentine.[4,5] As a result nanoleakage occurs leading to the hydrolytic breakdown of either the adhesive resin or collagen within the hybrid layer, thereby compromising the durability of dentine bonding interface.[6]

Dentine collagen fibrils degradation is managed by an intrinsic proteolytic activity of dentine collagenases/gelatinases, which would be responsible to cause a progressive disappearance of portions of hybrid layers over 6–12 months in vivo.[7] So far two kinds of endogenous proteolytic enzymes with potential collagenolytic/gelatinolytic activities were identified in dentine: the metalloproteinases (MMPs)[8–11] and the cysteine-cathepsins.[12–14] One strategy to avoid the endogenous collagenolytic activity is the use of protease inhibitors, such as chlorhexidine,[5,15–17] galardin,[18] or tetracycline.[19] It has been demonstrated that when chlorhexidine digluconate is used on demineralized dentine, after the acid etching and prior to the adhesive system application, it significantly improves the hybrid layer integrity, keeping a stronger bonding strength after short-term clinical trials.[7,20]

The aim of this study was to evaluate if an additional conditioning step, after etching and rinsing and prior to the adhesive application, could improve the clinical performance of adhesive restorations in non-carious cervical lesions. The null hypothesis is that the addition of the chlorhexidine digluconate conditioning step does improve the clinical durability of composite resin restorations.

2. Materials and methods

After the approval from the Federal University of Santa Catarina Internal Review Board, thirty patients with non-carious cervical lesions were selected for this study. Ten participants were excluded because they did not meet with all inclusion criteria or they fit in one exclusion criterion (Table 1).[21] Seventy non-carious cervical lesions were selected in 20 patients, 7 females and 13 males, with a mean age of 46.7 years (range 33–64).

Table 1 – Inclusion and exclusion criteria used in this research.

Inclusion criteria
•Patients over the age of 18;
•Patients living in or near to the university;
•Patients with more than 20 natural teeth;
•Presence of two or four non-carious cervical lesions in different hemiarches (1–3 mm of occluso-gingival height and 1–2 mm depth);
•Non-retentive cavities, presenting ≥50% of margins in enamel and ≥75% of total area in dentine;
•Presence of adjacent teeth (sound or restored);
•Cervical margins in dentine;
•Regular/good oral hygiene (bacterial plaque visible in <1/4 of teeth).
Exclusion criteria
•Patients unable to attend follow-up appointments;
•Pregnant or breast-feeding patients;
•Patients using analgesics and/or anti-inflamatory medicine;
•Patients with severe systemic or psychologic disease;
•Patients under orthodontic therapy, using fluoride supplements or desensitizing agents;
•Patients with bruxism;
•Patients with periodontal/gingival disease;
•Presence of caries, cracks, fractures, premature contact or unsatisfactory restorations;
•Presence of sclerotic dentine (degree 4), according to the classification of North Carolina University.[25]

All selected lesions were ''V'' or ''U'' shaped in the buccal surface of teeth with incisal/occlusal margin in enamel and gingival margin in dentine. The lesions were categorized in terms of sensitivity (spontaneous or provoked), cervico-incisal height (1.0–1.5 mm, 1.6–2.5 mm or 2.6–3.0 mm), depth (≤1.5 mm or >1.5 mm), degree of dentinal sclerosis (no sclerosis, slight, moderate),[22] and presence of wear facets (present or absent). The data of pre-operative evaluation of selected lesions are presented in Table 2.

2.1. Experimental design and restorative procedures

The best clinical trial to evaluate the effect of chlorhexidine digluconate used under adhesive restorations is the split-mouth design. This design was selected because all patients receive restorations with both adhesive techniques, in different quadrants, reducing the influence of patient individual factors such as sensibility, diet, life style, occlusion, and habits on results.[23] Thus, after being randomly assigned, each patient received the same number of restorations of both groups, following the split-mouth design. Seventy lesions, 35 per group, were restored in 20 patients. Five of them received 2 restorations, one each group, the others 15 patients received 4 restorations, as it is showed in the flow diagram of patients and restoration in this study (Fig. 1).

Before the adhesive procedures the teeth were cleaned with pumice-water slurry using Robinson brushes with a slow-speed handpiece to remove salivary pellicle and any bacterial plaque. The tooth shade was selected using a shade guide (VitaPan Classic, *Vita* Zahnfabrik, Bad Säckingen, Germany) and the operative field isolation was accomplished