

Original Research

Clinical evaluation of adhesive restorations with and without Proanthocyanidins in Non Carious Cervical Lesions

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ABSTRACT:

Background: The degradation of hybrid layer in an adhesive restoration occurs with time leading to restoration failure. The current research aims to investigate the clinical efficacy of using dentin adhesive applied over proanthocyanidin-treated dentin for composite restorations in Non Carious Cervical Lesions (NCCLs). The study intends to compare the performance of the adhesive restoration with the modified US Public Health Service (USPHS) criteria. **Material and Methods:** In this research, a group of 100 individuals with Non Carious Cervical Lesions was chosen, and they had been separated into 2 groups. The first group had been treated with a proanthocyanidin solution throughout the bonding process and subsequently restored with nanofilled composite. This group was the experimental cohort. The second cohort, which had been the control group, received resin restoration without any modification to the dentin. To assess the clinical performance of the treatments, 2 examiners evaluated the outcomes after one week, six months, and twelve months using modified USPHS criteria. The outcomes had been documented, as well as statistical analysis had been conducted. **Results:** Although there was no statistical significance, the group which received the proanthocyanidin solution showed superior outcomes for various clinical criteria compared to the control group at six as well as twelve months. Nevertheless, when assessed within each group at different time intervals, the control group demonstrated numerically considerable differences for retention as well as marginal adaptation. At six months, there occurred a loss of retention, however there was no further loss at the end of twelve months. **Conclusion:** When assessed for a duration of twelve months, the use of proanthocyanidin conditioning throughout the adhesive procedure for composite restoration in NCCLs didn't lead to any improvement among multiple clinical parameters in comparison to the control cohort.

Keywords: Proanthocyanidins, Non-Carious Cervical Lesions.

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INTRODUCTION

An adhesive is used in restorative dentistry to promote a strong bond between the restorative material and the dentin substrate. However, restorations, most often fail due to marginal failure at the gingival floor, suggesting that the dentin adhesive interface is the weakest link.¹ During bonding to dentin, the adhesive monomers thoroughly infiltrate and encapsulate the exposed collagen fibrils, creating the hybrid layer. However, deterioration of this hybrid layer takes place due to various physical and chemical factors. It has been found that bacterial enzymes, host-derived matrix metalloproteinases (MMPs) play a role in degradation of the exposed collagen. An application of an acid during the etching procedure can further lead to

activation and increased expression of MMPs in the substrate, thus increasing the risk of an enzymatic breakdown of the newly formed hybrid layer.^{2,3} Collagen in biological tissue is strengthened by the formation of native cross-linkers that provide the fibrillar resistance against enzymatic degradation as well as increase tensile properties.⁴ Proanthocyanidins(PA) is a natural collagen crosslinker, a MMPs inhibitor, potent antioxidant and belongs to a subgroup of the flavonoid compounds with low toxicity.^{5,6} In vitro studies have shown that using PA as a bio modifying agent, improved the stability of dentine matrix, when used during bonding procedure.⁷ A recent study has shown that application of PA was capable of improving dentin collagen's

biological stability within clinical time period of 10s.^{8,9} Hence PA can be tried in a clinical setup too. There are no clinical studies on long-term stability of resin dentine interface with PA being used for modifying the demineralized collagen during the bonding procedure. Null hypothesis was that there is no improvement in the clinical durability of the dentin adhesives by bio modification of collagen with PA. Hence, this study was designed to assess the clinical durability of dentin adhesives by modification of collagen with 95% PA during the bonding procedure for the placement of composite resin restorations in Non Carious Cervical Lesions (NCCLs) for a period of 1 year, using modified US public health service (USPHS) criteria.

MATERIALS AND METHODS

Normal control subjects belonging to the age group of thirty to fifty years with one or multiple NCCLs had been chosen. Subjects undergoing orthodontic treatment as well as bruxers had not been selected for study. 85 NCCLs had been therefore chosen and using split mouth design, had been assigned to either experimental or control cohort. The lesions had been classified on the basis of sensitivity, cervico incisal height, lesion depth as well as existence of wear facets had been assessed. Prior to the adhesive procedure, the teeth had been cleaned using pumice water slurry.

The restoration procedure involved building up the restoration with a nanofilled composite in 2 or 3 increments, beginning from the occlusal wall and approaching towards the gingival margin. Each increment had been light-cured for twenty seconds. Final contouring as well as polishing of the restorations had been finished throughout the same appointment with an extra-fine grit needle-shaped diamond point accompanied by polishing. The control cohort was restored with the same protocol, but without the use of PA. 2 calibrated examiners, who were uninformed of the treatment, assessed the restorations at 3 distinct durations: seven days, six months, as well as one year, using modified USPHS criteria. The research data had been assessed with SPSS (Statistical Package for Social Sciences, IBM, Corp). The proportional distribution of the research parameters in both cohorts and at distinct time periods was evaluated with the help of chi-square test.

RESULTS

20 men as well as 10 women having an overall 85 NCCLs had been chosen for the research. There had been no numerically considerable variation among control as well as experimental group at six months as well as twelve-month duration with respect to all criteria. The lesion characteristics namely- sensitivity, cervico-incisal height, lesion depth as well as presence of wear facets didn't reveal any association.

DISCUSSION

Dentin is a structured biological tissue that possesses elastic properties owing to its higher organic content in comparison to enamel. The organic matrix of dentin is mainly made up of type I collagen, which has inherent cross-links that enhance its structural stability. Pro MMPs (matrix metalloproteinases) are present in dentin during its formation and can be activated into active enzymes when released from dentin due to a decrease in pH to 4.5 or below.

A study by Mazzone et al¹⁰ have demonstrated that host-derived MMPs are responsible for collagen degradation. Collagen cross-linking agents can improve the mechanical properties of the dentin matrix, decrease the degradation rate of collagen, enhance the properties of dentin-resin bonds, and extend the lifespan of adhesive restorations.¹¹ Several natural and synthetic agents have been introduced in dentistry to inhibit protease enzymes and strengthen collagen fibrils, including carbodiimide, chlorhexidine digluconate, glutaraldehyde, PA, genipine (GE), and hesperidin. CHX inhibits MMPs and cysteine cathepsins but lacks cross-linking ability, while GD has a collagen cross-linking effect and inhibitory effect on collagenases, but its high cytotoxicity is a concern.¹²

PA has high ability to bind to proline-rich proteins, like collagen and facilitate the enzyme proline hydroxylase activity that is essential for collagen biosynthesis.¹³ Liu et al.¹⁴ found that the poorly infiltrated demineralized dentin at the bottom of the hybrid layer can be mechanically strengthened by PA bio modification and it contributed to the stabilization of the bonding interface. PA, improved the ultimate tensile strengths and stiffness of demineralized dentine collagen.^{15,16} Several studies have included PA in adhesive resins and have shown beneficial outcomes however, the addition of PA into dental adhesive or in self-etch adhesives may disturb the resin polymerization and degree of conversion, subsequently affecting the mechanical properties of the resin.

In this research, the PA group showed better results for various clinical criteria than the control group at 6 months and 12 months, but there was no statistical significance, leading to the acceptance of the null hypothesis. The failure could be due to issues with the adhesive layer of the hybrid layer in both groups. This suggests that in the experimental group, the cross-linked dentin matrix only mechanically strengthened the bottom of the hybrid layer, where the demineralized dentin was inadequately infiltrated by resin. Moreover, PA is unable to prevent the hydrolytic breakdown of the polymers that constitute the bonds between dentin and resin. This may explain why the restorations of cavities treated with PA did not demonstrate a better clinical outcome compared to the control group.

CONCLUSION

Based on the assessment of several clinical parameters over a period of one year, it was discovered that there was no considerable variation among the group that underwent PA conditioning during the adhesive procedure for composite restoration in NCCLs as well as the control group. Therefore, it can be concluded that the PA conditioning did not have an effect on the clinical outcomes.

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