

The Effect of Etching procedures on Biofilm-Coated Dentin Adhesion

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Perspective

Introduction

Acid etching on an adherent substrate is a critical process to achieve successful adhesion between dental hard tissues (i.e., enamel or dentin) and restorative materials. Although the importance of phosphoric acid etching for dentin has been deemphasized due to the development of self-etch adhesives and self-adhesive resin cements, selective enamel etching with phosphoric acid is advocated to achieve better clinical performance with these self-etching materials. Since the biofilm coats all surfaces in the oral cavity, the dentin surface to be restored with the composite resin may also be coated for short or long periods [1]. If phosphoric acid etching can effectively remove the biofilm from the surface to which restorations will be bonded, clinicians will be able to obtain a clean and fresh surface predictably and quickly without additional treatment. Unfortunately, this study indicated that phosphoric acid etching either with or without chlorhexidine had effective bactericidal action, but both treatments were unable to completely remove alive and dead bacteria attached to the dentin surface. This deficiency resulted in significantly lower bond strengths compared with the biofilm-free control group. On the other hand, prophylaxis with a rubber cup and pumice remove the biofilm to a significant level, even though some bacterial cells were still partially covering the dentin surface and were entrapped in the dentinal tubules [2]. Surface prophylaxis with a rubber cup and pumice before acid etching led to significantly higher bond strength of the resin composite to the dentin than the rest of the test groups. However, it did not reach to the level of bond strength in the control group, which contained a biofilm-free dentin surface.

Description

The attachment of biofilms is known to be related to the roughness and hydrophilicity of the surface, surface energy, and extracellular polymeric substances of the biofilm. Specifically, the extracellular polymeric substance- a biopolymer of microbial origin consisting of proteins, glycoproteins, and glycolipids- provides functional and structural integrity for biofilms. The remnant biofilm on the dentin surface probably decreased the bond strength. Demineralization of the dentin surface with phosphoric acid in the bonding procedure generally exposes the collagen fibers in the dentin and opens the dentinal tubules, leading to the preparation for micromechanical interlocking with adhesive agents. In the region where the biofilm remains, the dentin surface could not be properly demineralized by phosphoric acid, preventing the appropriate hybridization with collagen fibers and adhesives as well as a resin tag formation within the dentinal tubules [3]. In the present study, even the mechanical pressure and friction with a rubber cup and pumice did not completely remove the biofilm, and could not restore the bond strength to the level of the biofilm-free group.

Adhesion between the dentin wall of tooth preparations and resin composites is a critical factor determining the success of direct or indirect restorations using resin composite. Based on the results of this study, efforts to remove the biofilm are essential because the remnant biofilm on the dentin surface hinders the adhesion with the resin

composite. To date, no study has attempted to determine the effect of surface treatments for biofilm-coated dentin such as acid etching on the biofilm removal and subsequent adhesion to a resin composite. Several studies have investigated whether pumice prophylaxis of the enamel surface before acid etching affects the adhesion of orthodontic brackets or resin composites [4]. Most of them have reported that pumice prophylaxis before acid etching had little effect on the enamel bond strength, despite the presence of organic debris on the surface without pumice prophylaxis. The contrary outcomes from this study might be due to differences in the experimental setup of the presence or absence of a biofilm coating, as well as the histological differences in enamel versus dentin. In fact, the biofilm on enamel surfaces can be easily removed via frequent tooth brushing.

Chlorhexidine has been used to clean the preparation surface due to its antibacterial effect, and it can induce durable resin-dentin adhesion by protecting against collagen degradation. The chlorhexidine molecule with a positive charge interacts with the negatively charged substance of the bacterial cell wall when low concentrations are used. The binding of chlorhexidine to the bacterial cell wall changes the osmotic equilibrium of the cell, causing the low-molecular weight substances to leak out. In high concentrations, chlorhexidine penetrates the bacterial cell wall, leading to bacterial cytoplasm precipitation [5]. In fact, the bactericidal effect of chlorhexidine was evidenced by a prominent increase in the population of bacterial dead cells in the chlorhexidine-treated groups compared with the group that did not receive chlorhexidine treatment in this study. However, other than the antibacterial effect, chlorhexidine treatment appears to have little ability in removing contaminants, including smear debris and remnants of provisional cement, from the dentin surface.

Conclusion

In this study, a single species of *S. mutans* was used, and saliva was initially coated but not continuously supplied. Therefore, the appearance of the biofilm may be different from the actual biofilm in the oral cavity, and the binding force between the bacteria and dentin may also be different. In situ experimental setups in the oral cavity might be needed to simulate the actual biofilm coating on tooth surfaces in future studies.

References

1. Scannapieco FA (1994) Saliva-bacterium interactions in oral microbial ecology. *Crit Rev Oral Biol Med* 5: 203-248.

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Received: 09-May-2022, Manuscript No. did-22-63242; Editor assigned: 11-May-2022, PreQC No. did-22-63242 (PQ); Reviewed: 25-May-2022, QC No. did-22-63242; Revised: 30-May-2022, Manuscript No. did-22-63242 (R); Published: 06-Jun-2022, DOI: 10.4172/did.1000152

Citation: Jim K (2022) The Effect of Etching procedures on Biofilm-Coated Dentin Adhesion. *Dent Implants Dentures* 5: 152.

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2. Marsh PD (2004) Dental plaque as a microbial biofilm. *Caries Res* 38: 204-211.
3. Marsh PD (2005) Dental plaque: Biological significance of a biofilm and community life-style. *J Clin Periodontol* 32: 7-15.
4. Oilo M, Bakken V (2015) Biofilm and dental biomaterials. *Materials* 8: 2887-2900.
5. Gultz J, Kaim J, Scherer W (1999) Treating enamel surfaces with a prepared pumice prophylaxis paste prior to bonding. *Gen Dent* 47: 200-201.