

## CHAPTER I

### INTRODUCTION

#### Background & Rationale

The ultimate goal of a dental bonding system is to achieve a good and durable bond to dental substrates. Secondary caries, marginal discoloration and marginal gap/fracture account for a significant majority of clinical diagnosis of restoration failure and reason for restoration replacement. These failures occur at the interface between restorative materials and cavity preparation. It is an underlying belief, or at least an underlying assumption of the dental profession, that improving the seal between a restorative material and tooth structure will reduce the frequency of such occurrences, which will in turn lead to enhanced restoration longevity.

Adhesive techniques have been developed to the extent that they are now used in most clinical procedures. Self-etching adhesives are becoming more popular, mainly because of their ease-of-use, fewer problems from acid etching, low technique-sensitivity from excess humidity on dentin after acid conditioning, and decrease in postoperative sensitivity (Sano *et al.*, 1995).

Self-etching adhesive bonding effectiveness was improved to the point of equivalent to that of etch-and-rinse system, especially the mild self-etching adhesive (pH around 2 or above) that dissolves only some part of mineral in dentin, resulting in the remaining of hydroxyapatite in hybrid layer. Collagen fiber is covered with hydroxyapatite crystal creating the hypothetical chemical bond to functional monomer (Yoshida *et al.*, 2004). Both *in vitro* and *in vivo* studies showed favorable bonding efficacy for the two-step self-etching adhesives (De Munck *et al.*, 2005c; Peumans *et al.*, 2005b). Although high early bond strengths of current adhesive systems to dentin have been reported, the durability of adhesive bond is still one of the areas of current interest in adhesive dentistry (Koshiro *et al.*, 2004).

A reduction of bond strength and morphological changes in the resin–dentin bond result from esterization in the resin in hybrid layer. Degradation of resin–dentin interface progress by diffusion of water through nanoleakage. Two step self-etching

adhesives have been found to create stable bonds of resin restorations similar to etch-and-rinse adhesives but showed more rapid progressive marginal degradation (Tanaka *et al.*, 1999). Mild self-etching adhesives adhere weakly to enamel due to the inability of mild acidic to dissolve minerals in enamel resulting in less bond strength and early marginal staining (De Munck *et al.*, 2003a). Self-etching adhesives are undoubtedly user-friendly adhesives; however, they have been associated with lower bonding effectiveness as compared to etch-and-rinse adhesives. These adhesives are usually used according to manufacturers' recommendations, but some have been found to perform better using modification of application methods other than that suggested by manufacturers (Frankenberger *et al.*, 2001).

The purpose of this study was to evaluate bonding effectiveness in extracted human teeth, by testing microleakage, when using mild self-etching adhesives according to manufacturers' instructions as control, compared to the modified application protocol by selective enamel acid etching using 37% phosphoric acid. Three commercially available adhesives were investigated.

### Objective

To evaluate microleakage at the enamel and dentin margins of class V cavity when using mild self-etching adhesives according to manufacturers' instructions compared to modified application protocol by selective enamel acid etching using 37% phosphoric acid.

### Limitation

The study was a laboratory experiment, the results of this *in vitro* study using tracer penetration must be considered as comparisons, and not as absolute conclusions.

### Keywords

Microleakage, mild self-etching adhesive, selective acid etching

## Hypothesis

H<sub>0</sub>: there was no significant difference in sealing ability of the mild self-etching adhesives when used according to manufacturers' instructions compared to modified protocol using selective enamel acid etching.

H<sub>1</sub>: there was a significant difference in sealing ability of the mild self-etching adhesives when used according to manufacturers' instructions compared to modified protocol using selective enamel acid etching.

## Expected benefit & Application

Self-etching adhesives show a faster progressive enamel marginal degradation. The result of this study will provide information regarding methods to improve bonding effectiveness of contemporary dentin adhesives by using selective acid etching on enamel surface.

## Experimental Design

The present study was performed in the laboratory setting to investigate bonding effectiveness by testing microleakage, when using 2 mild self-etching adhesives and one three-step etch-and-rinse system in extracted human teeth. The teeth were bonded according to manufacturers' instructions as control groups compared to groups that used selective etching on enamel surface using phosphoric acid before bonding. Three commercially available adhesives, a three-step etch-and-rinse adhesive; Optibond FL, a two-step self-etching adhesive; Clearfil SE Bond, and an one-step self-etching adhesive; Clearfil S<sup>3</sup> Bond (Kuraray, Japan), were investigated by determining microleakage that occurred after artificially aging with 5,000 cycles of thermocycling.