

SEM in the Studies on Dentine Adhesives

Language: English

Authors:

Prof. MUDr. Martina Kukletová, CSc., Stomatological Clinic, Medical Faculty, Masaryk University, Brno
 Prof. MUDr. Drahomír Horký, Dept. of Histology and Embryology, Medical Faculty, Masaryk University, Brno
 Ass. Prof. MUDr. Zdenka Halacková, CSc., Stomatological Clinic, Medical Faculty, Masaryk University, Brno

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Introduction

The development in the area of tooth-colored restorative materials is closely linked with the discovery that resin materials could be bound to acid-etched enamel. The studies on bonding dentine were soon performed, and they made possible to anchor a composite filling material to dentine, too. In the course of time, 6 generations of adhesive systems were developed. At present, two main techniques have been used: total-etched and self-etching. The studies on the character of a connection between dentine and an adhesive material can be conducted by different morphological methods. The aim of the paper presented was to compare different SEM techniques and to determine the most suitable method for studying the dentine adhesion.

Objectives

New materials have been introduced to esthetic dentistry, and their properties and connection to hard dental tissues are verified by different morphological studies. The problem may be a choice of the most suitable method for a given research.

Material and Methods

Sixteen teeth extracted for orthodontic reasons were used for the trial. The teeth were kept in 10% neutral formaline. The cavities of the Ist and Vth classes were prepared, and their surfaces were treated with dentine adhesives. Eight teeth were treated with total-etch technique using Prime bond or Single bond, and 8 teeth were treated with self-etching technique using Xeno III or Prompt-L-Pop materials. The teeth were fractured, and the fractured surfaces were studied in SEM. One-half of each tooth was studied under low-vacuum technique (LowVac) using BSE and LVSTD detectors, the other was gold-coated and investigated under high vacuum (HiVac) using SE and BSE detectors.

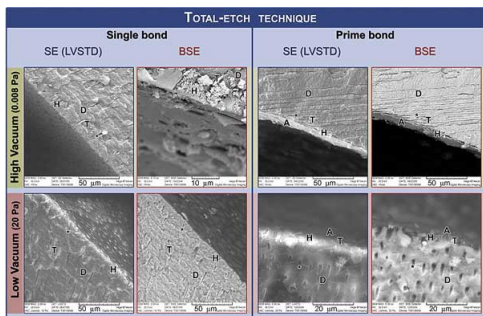


Fig. 1. Total-etch technique

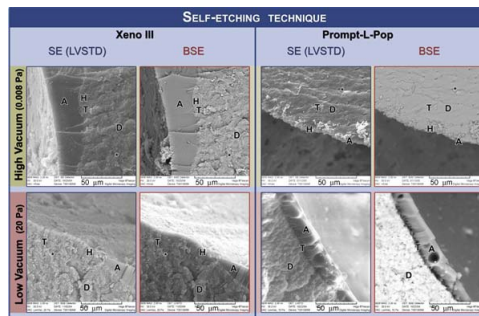


Fig. 2. Self-etching technique

Results

In both techniques a good connection between dentine and adhesive materials was found. A hybrid layer was formed, and the tags of resin penetrated into the dentinal tubules. In total-etch technique longer tags were observed regularly. HiVac technique provided a sharper and more distinct picture of the situation and enabled the studies in greater details. No substantial differences between the applied detectors were found.

Conclusions

Scanning electron microscopy is frequently used in the research in various fields of dentistry (Nakabayashi and Pashley 1998, Hasshoff, Schneider and Merte 2004, Tsuchia et al. 2004, Wang and Spenser 2004). The technique for a sample preparation is relatively easy, and large areas of tissue under interest may be studied. Investigation in SEM is performed under high vacuum, and the samples have to be metal coated. Recently, a new technique working under low vacuum has been introduced into scanning electron microscopy. This low vacuum environment is useful for the three-dimensional analysis of the surface morphology of biological samples (Ushiki et al 1998). Soft and hard tissues can be studied under low vacuum conditions (Bonnema et al. 1997, Jeng et al 1999, Erwin 2003, Al-Qahtani et al 2003, Shipper et al 2004). Shipper et al (2004) studied marginal adaptation of mineral trioxide aggregate and amalgam under LowVac versus HiVac and reported that the best results were achieved under LowVac investigation. Our previous study on adhesive systems (Kukletová et al 2005) has demonstrated that LowVac technique can distinguish different materials used while gold coated HiVac technique masked that connection. The present study, however, found the HiVac technique more suitable for the detailed investigation of dentine adhesion and it will be preferred in further studies. The study was supported by IGA grant No 8055-3 from the Czech Ministry of Health.

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Abbreviations

SEM = scanning electron microscopy
LowVac = low vacuum
HiVac = high vacuum
T = tags of the dentine adhesives
D = dentine
A = dentine adhesives
H = hybrid layer
asterisk = dentine tubule

This Poster was submitted by Prof. MUDr. Martina Kukletová.

Correspondence address:

Prof. MUDr. Martina Kukletová
CSc., Stomatological Clinic, Medical Faculty
Masaryk University
Pekarská 53
656 91 Brno
Czech Republic



SEM IN THE STUDIES ON DENTINE ADHESIVES

Kukletová¹ M., Horký² D., Halačková¹ Z.

¹Clinic of Stomatology, Medical Faculty, Masaryk University, Brno

²Dept. of Histology and Embryology, Medical Faculty, Masaryk University, Brno

INTRODUCTION

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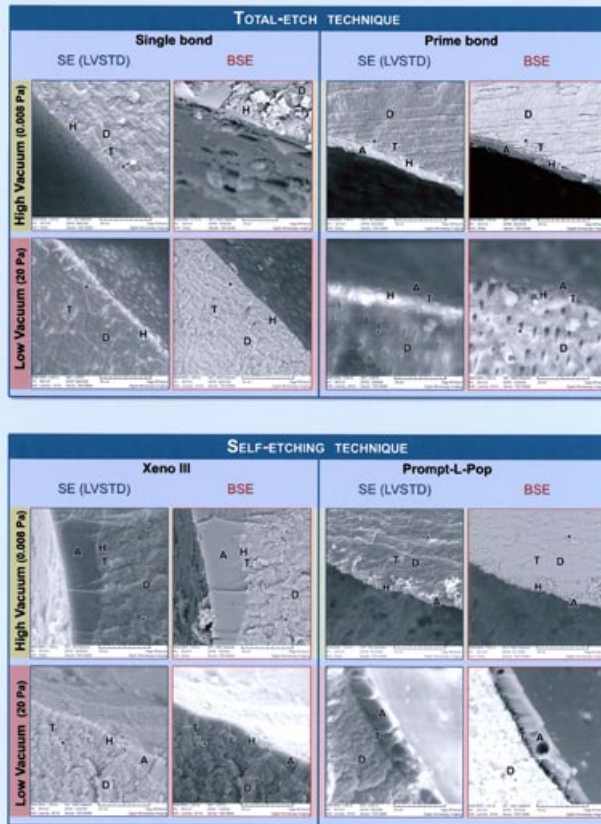
RESULTS

In both techniques a good connection between dentine and adhesive materials was found. A hybrid layer was formed, and the tags of resin penetrated into the dentinal tubules. In total-etch technique longer tags were observed regularly. HiVac technique provided sharper and more distinct picture of the situation and enabled the studies in greater details. No substantial differences between the applied detectors were found.

CONCLUSION

HiVac technique will be preferred in further studies on the quality of dentine adhesive techniques and materials.

The study was supported by IGA grant No 8055-3 from the Czech Ministry of Health.



EXPLANATION TO FIGURES

T = tags of the dentine adhesives
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asterisk = dentine tubule

A = dentine adhesives
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