



---

Year: 2012

---

## Protection of sound enamel and artificial enamel lesions against demineralisation: caries infiltrant versus adhesive

Schmidlin, P R; Sener, B; Attin, T; Wiegand, A

**Abstract:** **OBJECTIVE:** To compare the protective potential of a conventional adhesive, a caries infiltrant and a combination of both against acidic challenge in vitro. **METHODS:** One-hundred-and-fifty discs from bovine lower central incisors were fabricated. Seventy-five samples remained untreated, whereas the other half was subjected to a demineralisation process (14 days, acidic buffer, and pH 5) to create artificial enamel lesions. Specimens were then radioactively irradiated, and each 15 sound and demineralised specimens were treated with a caries infiltrant (Icon, DMG), an unfilled adhesive (Heliobond, Ivoclar Vivadent) or a combination of infiltrant and adhesive. Specimens treated with the adhesive followed by a flowable composite (TetricEvoFlow, Ivoclar Vivadent) served as positive control, while untreated specimens served as negative control. All samples were then subjected to lactic acid for 3 weeks at pH 4. Loss of apatite was determined using the radiochemical method of liquid scintillation. Data were statistically analysed by Kruskal-Wallis-test, one-way ANOVA and Scheffe's post hoc tests ( $p < .05$ ). **RESULTS:** In both sound enamel and artificial caries lesions, untreated specimens showed the highest rate of apatite loss, whereas enamel treated with the adhesive and the flowable composite showed almost complete protection surface against dissolution. The caries infiltrant, the adhesive and the combination of both were able to decrease enamel dissolution, but the adhesive and the combination of adhesive and infiltrant were more effective than the infiltrant alone. **CONCLUSION:** Within the limitations of this in vitro study, the application of an adhesive (alone or in combination with the caries infiltrant) is more effective to protect enamel dissolution than the infiltrant alone.

DOI: <https://doi.org/10.1016/j.jdent.2012.07.003>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-74978>

Journal Article

Accepted Version

Originally published at:

Schmidlin, P R; Sener, B; Attin, T; Wiegand, A (2012). Protection of sound enamel and artificial enamel lesions against demineralisation: caries infiltrant versus adhesive. *Journal of Dentistry*, 40(10):851-856.

DOI: <https://doi.org/10.1016/j.jdent.2012.07.003>

**Protection of sound enamel and artificial enamel lesions against demineralisation: caries infiltrant versus adhesive**

**Short title: Enamel dissolution protection by infiltrant and adhesive**

PR Schmidlin, B Sener, T Attin, A Wiegand

Clinic of Preventive Dentistry, Periodontology and Cariology, Center for Dental Medicine,  
University of Zurich, Plattenstrasse 11, 8032 Zurich, Switzerland

**Corresponding author**

PD Dr. Patrick R. Schmidlin

Clinic of Preventive Dentistry, Periodontology and Cariology, University of Zurich  
Plattenstrasse 11, 8032 Zürich, Switzerland

Email: [patrick.schmidlin@zzm.uzh.ch](mailto:patrick.schmidlin@zzm.uzh.ch)

Phone: 0041-44-6343417

**Keywords:** Enamel; demineralisation; caries infiltration; liquid scintillation; SEM; In vitro

## **Protection of sound enamel and artificial enamel lesions against demineralisation: caries infiltrant versus adhesive**

### **Abstract**

*Objective:* To compare the protective potential of a conventional adhesive, a caries infiltrant and a combination of both against acidic challenge in vitro.

*Methods:* One-hundred-and-fifty discs from bovine lower central incisors were fabricated. Seventy-five samples remained untreated, whereas the other half was subjected to a demineralisation process (14 days, acidic buffer, pH 5) to create artificial enamel lesions. Specimens were then radioactively irradiated, and each 15 sound and demineralised specimens were treated with a caries infiltrant (Icon, DMG), an unfilled adhesive (Heliobond, Ivoclar Vivadent) or a combination of infiltrant and adhesive. Specimens treated with the adhesive followed by a flowable composite (Tetric EvoFlow, Ivoclar Vivadent) served as positive control, while untreated specimens served as negative control. All samples were then subjected to lactic acid for 3 weeks at pH 4. Loss of apatite was determined using the radiochemical method of liquid scintillation. Data were statistically analysed by Kruskal-Wallis-test, one-way ANOVA and Scheffe`s post-hoc tests ( $p < =.05$ ).

*Results:* In both sound enamel and artificial caries lesions, untreated specimens showed the highest rate of apatite loss, whereas enamel treated with the adhesive and the flowable composite showed almost complete protection surface against dissolution. The caries infiltrant, the adhesive and the combination of both were able to decrease enamel dissolution, but the adhesive and the combination of adhesive and infiltrant were more effective than the infiltrant alone.

*Conclusion:* Within the limitations of this in vitro study, the application of an adhesive (alone or in combination with the caries infiltrant) is more effective to protect enamel dissolution than the infiltrant alone.

**Keywords:** Enamel, demineralisation, caries infiltration, liquid scintillation, SEM, In vitro

## Introduction

Pit and fissure sealing with composite resins bonded to enamel is an effective procedure for caries prevention.<sup>6,32</sup> Based on the good clinical results with sealing of these mentioned predilection sites, approaches have been made to extend this preventive concept to smooth enamel surfaces.<sup>25,26</sup> Among the latter, interproximal areas have the highest risk for caries development.<sup>1,9</sup> The infiltration of caries lesions with low-viscosity light curing resins is considered as treatment option for non-cavitated lesions, which are not expected to arrest or remineralise. In contrast to the conventional sealing concept where a resin layer is created on the surface, caries infiltrants aim to penetrate the porous lesion body thoroughly.<sup>7,14</sup> Compared to conventional dental adhesives, caries infiltrants were optimized for rapid capillary penetration and exhibit a very low-viscosity, low contact angle to enamel and high surface tension.<sup>13</sup> As a consequence, laboratory experiments demonstrated a significantly deeper penetration in the lesion body than conventional adhesives.<sup>11,12</sup> However, in spite of the deeper penetration of caries lesions, it has not been shown yet that caries infiltration as an increased capability to prevent progression of demineralisation than conventional sealing of the lesion.<sup>19</sup> While both infiltrants<sup>11,18,20</sup> and adhesives<sup>16,24</sup> were shown to be effective in reducing progression of artificial enamel lesions, their protective potential on sound enamel was not compared so far. This aspect might be of interest in areas neighbouring the lesion, which might be at risk to be affected by demineralisation if the lesion progresses.

Therefore, the aim of the present study was to compare the potential of a conventional adhesive, a caries infiltrant and a combination of both to protect sound enamel and artificial enamel lesion against an acidic challenge in vitro. The hypotheses were that protective capability of the infiltrant and the adhesive do not differ, and that the combination of both is comparable to the respective treatments alone.

## Methods

### *Specimen preparation*

Specimens were prepared from 150 extracted bovine permanent incisors. Only tooth material free of defects or cracks was selected. The teeth were cleaned and sectioned at the enamel-cementum junction using a water-cooled cutting wheel (Isomet, Buehler, Illinois, USA). The labial surface of the teeth was cleaned by brushing during 25 min. Brushing was performed in a custom-made brushing machine at 2.5 N with a manual toothbrush (ParoM39, ESRO, Thalwil, Switzerland) and a toothpaste-slurry (6 g Depurident, Wild SA, Basel, Switzerland; 10 g artificial saliva; 8 drops of a silicone antifoam, Fluka, Art. Nr. 85390, Switzerland). Discs with a diameter of 7 mm were cut from the mid-labial aspect of each tooth using a custom-made diamond-coated trephine (80µm, Intensiv SA, Lugano-Grancia, Switzerland). The discs were then flattened from the bottom to approximately 2 mm in height (Struers, Birmensdorf). Then, half of the specimens were immersed for 14 days in an acidic buffer containing 3 mM  $\text{CaCl}_2 \times 2 \text{H}_2\text{O}$ , 3 mM  $\text{KH}_2\text{PO}_4$ , 50 mM acetic acid, 6 µM MHDP, KOH to adjust the initial pH to 5.0 and traces of thymol.<sup>4</sup> This solution was renewed each second day to keep the pH constant.

The Specimens were irradiated at the "Atominstitut der Österreichischen Universitäten" (Vienna, Austria) with an exposure time of 85 min to a neutron flow of  $1.02 \times 10^{12}$  neutrons/cm<sup>2</sup>.s, resulting in a  $\beta^-$ -activity of 0.56 Gbq/p.

### *Treatment procedure*

Before the enamel treatment, all surfaces except the top enamel test surface were carefully sealed with unfilled bonding agent (Heliobond, Ivoclar-Vivadent, Schaan, Liechtenstein) and a flowable composite resin (Tetric EvoFlow, Ivoclar Vivadent, Schaan, Liechtenstein). Therefore, the lateral cutted enamel was carefully etched with 35% phosphoric acid (UltraEtch 35%, Ultradent Products, South Jordan, USA) and rinsed with distilled water for 60 s before the sealing procedure.

Then, 75 sound and 75 demineralised samples were randomly assigned to five groups (15 samples each) and treated as follows:

1. The enamel surface was etched for 60 s with 35% phosphoric acid (UltraEtch 35%, Ultradent Products, South Jordan, USA), and then rinsed distilled water for 60 s. After air drying of the surface, an unfilled adhesive (Heliobond, Ivoclar Vivadent, Schaan, Liechtenstein) was applied for 20 s with a microbrush, then thinned with mild air (1-2 s) and light cured for 20 s (3M Espe Elipar S10, 3M Espe, Seefeld, Germany).
2. The enamel surface was etched for 2 min with 15% hydrochloric acid (Icon Etch, DMG, Hamburg, Germany) and then rinsed with water spray for 30 s. Air drying of the surface was followed by application of ethanol (Icon Dry, DMG, Hamburg, Germany) for 30 s and additional air drying. Then, the low-viscosity resin infiltrant (Icon Infiltrant, DMG, Hamburg, Germany) was applied on the surface for 3 min by means of the sponge applicator provided with the resin infiltration system. After light-curing for 40 s, the infiltrant was applied for further 60 s and again light-cured for 40 s.
3. Specimens were first treated with the caries infiltrant as described under point 2. Then, the adhesive was applied and light cured for 20 s.
4. Same treatment as under point 1 but additional application of a flowable composite resin material (Tetric EvoFlow, Ivoclar Vivadent, Schaan, Liechtenstein), which was light cured for 40 s (3M Espe Elipar S10, 3M Espe, Seefeld, Germany); positive control
5. No sealing; negative control

The composition of the adhesive systems and materials based on the manufacturers' instructions are listed in Table 1.

#### *Acidic challenge and evaluation of mineral loss*

All specimens were immersed at 37 °C under constant motion for up to 21 days in 5 ml of artificial saliva or 5 ml lactic acid (15 µmol/l, pH 4).

After 1, 2, 4, 7, 11, 14 and 21 days, immersion solutions were collected, the weight of each sample was measured and 1 ml 2N HCl plus 4 ml distilled water were added to an end volume of 10 ml.  $^{32}\text{P}$  was assessed by determining the Cherenkow radiation. For calculation of mineralised tissue loss standard solutions of  $^{32}\text{P}$  and apatite, together with a background sample were prepared, as described elsewhere.<sup>27</sup> In short, the resulting counts per minute (CPM) were calculated to the date of irradiation, resulting in decays per minute (DPM). The arithmetic mean of the samples was calculated and the amount of dissolved mineralised tissue was calculated with the aid of the apatite standard.

#### *Morphological assessment*

For the SEM analysis, two additional specimens of each group were prepared for examination of the surfaces directly after application of the test materials and after 21 d storage in lactic acid. Specimens were dehydrated in a desiccator device (Optivac, König Physik, Diemelstadt, Germany) using blue silica gel, sputter-coated with gold and examined at 10 kV (Zeiss Supra 50 VP, Zeiss, Oberkochen, Germany).

#### *Data presentation and analysis*

Statistical analysis was performed with StatView (Version 5, Abacus Concepts Inc., Berkley, USA).

Cumulative mineral loss in  $\mu\text{g}$  apatite was calculated for each group. Normal distribution was tested using Kolmogorov-Smirnov and Shapiro-Wilk tests.

As data were not normally distributed, non-parametric statistics (Kruskal-Wallis test) were applied within sound specimens and within specimens with artificial lesions to analyse possible differences between the groups at the different time points. Non-parametric statistics were followed by one-way ANOVA, separately for sound and demineralised enamel, and Scheffe's post-hoc tests. The level for statistical significance was set at  $p < 0.05$ .

## **Results**

### *Mineral loss*

In both sound enamel and enamel exhibiting artificial lesions, Kruskal-Wallis tests revealed significant differences between the groups at each time point. Cumulative enamel loss at the evaluated time points is presented in Figures 1 and 2.

Untreated specimens showed the highest rate of apatite loss over the whole observation period, whereas enamel treated with the adhesive and the flowable composite showed almost complete protection surface against dissolution at all time points. The caries infiltrant, the adhesive and the combination of the infiltrant and the adhesive reduced apatite dissolution significantly, but the adhesive and the combination of infiltrant and adhesive were more protective against acid dissolution than the infiltrant alone, irrespective whether sound or demineralised enamel was treated.

### *Morphological aspects*

The morphological appearances of the sound and predemineralised specimens before and after storage in lactic acid for 21 days are presented in Figure 3, respectively.

Untreated enamel exposed to lactic acid showed only minute surface changes (Figure 3 B). Application of the caries infiltrant system induced a severe demineralisation with a honeycomb appearance of enamel (Figure 3 I). In contrast, the enamel surface appeared smooth after application of the adhesive or the combination of caries infiltrant and adhesive, even after storage in lactic acid for 21 days (Figure 3 M/N).

Artificial-caries like lesions revealed a demineralised surface (Figure 3 C). While application of the caries infiltrant increased/modified demineralisation (Figure 3 K), the adhesive induced a sealing of the surface (Figure 3 G), which was still present after 21 d storage in lactic acid (Figure 3 H/P).



## Discussion

This study demonstrated that both a caries infiltrant system and a conventional adhesive protect sound enamel and artificial enamel lesions from further demineralisation. However, the adhesive and the combination of infiltrant and adhesive were more effective than the caries infiltrant alone.

In the present study, bovine teeth were used, which are widely used in resin infiltration tests.<sup>16,19</sup> Following the same irradiation protocol as in previous studies,<sup>28,29</sup> the cumulative mineral loss of untreated samples comparing the results of the present investigation revealed remarkably comparable results with median losses of 580 and 660 µg apatite, respectively. The samples had the same pretreatment and geometry, but the embedding was slightly different. In the present study, we used an adhesive embedding of the discs, which revealed a more reliable lining and sealing of the irradiated samples during the dissolution process. The median mineral loss in the former study was still 26 µg apatite as compared to nearly zero in this investigation.

As in previous studies lactic acid was used for the demineralisation regime as it represents the main organic acid produced by dental plaque bacteria.<sup>5,28,29</sup> However, it should be acknowledged that the study conditions differed from the in vivo situation in that there was no protective salivary pellicle and that enamel surfaces were in continuous contact with the acidic challenge.

In this study artificial lesions of about 150 µm depth were used.<sup>2</sup> However, although these lesions were shown to exhibit some of the typical histological structure of intact enamel caries including the intact surface layer,<sup>8</sup> the histological condition of the surface and subsurface layers is unpredictable in the clinical situation. The surface layer is thicker in natural (~ 40 to 50 µm and) compared to artificial (~ 20 µm) lesions,<sup>3</sup> but it was shown that hydrochloric acid etching is required not only for natural<sup>23</sup> but also for artificial caries lesions<sup>2</sup> to remove the surface layer completely and allow for successful penetration of the infiltrant. It was therefore decided to use the infiltration material as provided in the commercially

available kit, i.e. using hydrochloric acid conditioning material. Heliobond was chosen as a representative of an unfilled enamel bonding agent as it exhibits potential to penetrate at least early enamel lesions.<sup>10,13,30</sup> However, it has to be considered that natural enamel lesions might be much deeper than the artificial lesions created in the present study. Therefore, an incomplete penetration under natural caries conditions is possible.

While resin infiltrants led to a complete, but partially inhomogenous penetration of artificial lesions, Heliobond was shown to induce the formation of a homogenous surface layer, but penetrated only the outer part of the lesion.<sup>13</sup> The results of the present study indicate that the superficial penetration and surface coating of the adhesive might be more effective in protecting enamel dissolution than the penetration of the infiltrant. This observation is also evident in the morphological evaluation of this study. While the surfaces treated with the caries infiltrant exhibited a demineralised appearance, the other test groups revealed a dense adhesive layer, respectively. While the amount of TEGDMA in the resin infiltrant promotes the penetration of the resin,<sup>22</sup> it also increases the susceptibility to degradation compared to resins containing less TEGDMA<sup>17,31</sup>. Moreover, the surface leakage might be a result of polymerization shrinkage and polymerization stress of the resin.<sup>21</sup> However, surprisingly, the infiltrant alone showed some protection against the acid dissolution even in sound enamel, which does not represent a substrate for the infiltrant.

However, in both substrates, the combination of both materials was not more effective than the adhesive alone. At least for artificial enamel lesions it was assumed that the infiltration of the demineralised subsurface layer and the sealing of the surface might have an additive effect on the dissolution protection. As the bonding of the adhesive is not impaired on infiltrated enamel surfaces,<sup>33</sup> this observation cannot be explained yet. However, covering infiltrated lesions with an adhesive layer might be beneficial in terms of surface properties, as surface roughness of infiltrated lesions is comparatively high<sup>15</sup>.

## **Conclusion**

The application of an adhesive (alone or in combination with the caries infiltrant) is more effective to protect enamel dissolution than the infiltrant alone within the limitations of this in vitro study.

## References

1. Alm A, Wendt LK, Koch G, Birkhed D. Prevalence of approximal caries in posterior teeth in 15-year-old Swedish teenagers in relation to their caries experience at 3 years of age. *Caries Research* 2007;**41**:392-398.
2. Belli R, Rahiotis C, Schubert EW, Baratieri LN, Petschelt A, Lohbauer U. Wear and morphology of infiltrated white spot lesions. *Journal of Dentistry* 2011;**39**:376-385.
3. Bergman G, Lind PO. A quantitative microradiographic study of incipient enamel caries. *Journal of Dental Research* 1966;**45**:1477-1484.
4. Buskes JA, Christoffersen J, Arends J. Lesion formation and lesion remineralization in enamel under constant composition conditions. A new technique with applications. *Caries Research* 1985;**19**:490-496.
5. Fejerskov O, Thylstrup A. Pathology of dental caries. In: Thylstrup A, Fejerskov O, editors. *Textbook of Cariology*. Copenhagen: Munksgaard; 1996; p. 204-235.
6. Horowitz HS, Heifetz SB, Poulsen S. Retention and effectiveness of a single application of an adhesive sealant in preventing occlusal caries: final report after five years of a study in Kalispell, Montana. *Journal of the American Dental Association* 1977;**95**:1133-119.
7. Kielbassa AM, Muller J, Gernhardt CR. Closing the gap between oral hygiene and minimally invasive dentistry: a review on the resin infiltration technique of incipient (proximal) enamel lesions. *Quintessence International* 2009;**40**:663-681.
8. Moron BM, Comar LP, Wiegand A, Buchalla W, Buzalaf MA. Comparison of cross-sectional hardness and transverse microradiography of artificial carious enamel lesions induced by different demineralising solutions and gels. *Caries Research* 2009;**43**:474-483.
9. Menghini G, Steiner M, Marthaler T, Helfenstein U, Brodowski D, Imfeld C, Weber R, Imfeld T. Caries prevalence among students in 16 Zurich districts in the years 1992 to 2000. *Schweizer Monatsschrift für Zahnmedizin* 2003;**113**:267-277.

10. Meyer-Lueckel H, Mueller J, Paris S, Hummel M, Kielbassa AM. The penetration of various adhesives into early enamel lesions in vitro. *Schweizer Monatsschrift für Zahnmedizin* 2005;**115**:316-323.
11. Meyer-Lueckel H, Paris S. Progression of artificial enamel caries lesions after infiltration with experimental light curing resins. *Caries Research* 2008;**42**:117-124.
12. Meyer-Lueckel H, Paris S. Improved resin infiltration of natural caries lesions. *Journal of Dental Research* 2008;**87**:1112-1116.
13. Meyer-Lueckel H, Paris S, Mueller J, Colfen H, Kielbassa AM. Influence of the application time on the penetration of different dental adhesives and a fissure sealant into artificial subsurface lesions in bovine enamel. *Dental Materials* 2006;**22**:22-28.
14. Meyer-Lueckel H, Chatzidakis A, Naumann M, Dörfer CE, Paris S. Influence of application time on penetration of an infiltrant into natural enamel caries. *Journal of Dentistry* 2011;**39**:465-9
15. Mueller J, Yang F, Neumann K, Kielbassa AM. Surface tridimensional topography analysis of materials and finishing procedures after resinous infiltration of subsurface bovine enamel lesions. *Quintessence International* 2011;**42**:135-147.
16. Mueller J, Meyer-Lueckel H, Paris S, Hopfenmuller W, Kielbassa AM. Inhibition of lesion progression by the penetration of resins in vitro: influence of the application procedure. *Operative Dentistry* 2006;**31**:338-345.
17. Ortengren U, Wellendorf H, Karlsson S, Ruyter IE. Water sorption and solubility of dental composites and identification of monomers released in an aqueous environment. *J Oral Rehabil* 2001;**28**:1106-1115.
18. Paris S, Hopfenmuller W, Meyer-Lueckel H. Resin infiltration of caries lesions: an efficacy randomized trial. *Journal of Dental Research* 2010;**89**:823-826.
19. Paris S, Meyer-Lueckel H. Inhibition of caries progression by resin infiltration in situ. *Caries Research* 2010;**44**:47-54.
20. Paris S, Meyer-Lueckel H. Infiltrants inhibit progression of natural caries lesions in vitro. *Journal of Dental Research* 2010;**89**:1276-1280.

21. Paris S, Meyer-Lueckel H, Colfen H, Kielbassa AM. Resin infiltration of artificial enamel caries lesions with experimental light curing resins. *Dental Materials Journal* 2007;**26**:582-588.
22. Paris S, Meyer-Lueckel H, Colfen H, Kielbassa AM. Penetration coefficients of commercially available and experimental composites intended to infiltrate enamel carious lesions. *Dental Materials* 2007;**23**:742-748.
23. Paris S, Meyer-Lueckel H, Kielbassa AM. Resin infiltration of natural caries lesions. *Journal of Dental Research* 2007;**86**:662-666.
24. Paris S, Meyer-Lueckel H, Mueller J, Hummel M, Kielbassa AM. Progression of sealed initial bovine enamel lesions under demineralizing conditions in vitro. *Caries Research* 2006;**40**:124-129.
25. Phark JH, Duarte SJ, Meyer-Lueckel H, Paris S. Caries infiltration with resins: a novel treatment option for interproximal caries. *Compendium of Continuing Education in Dentistry* 2009;**30**:13-17.
26. Schmidlin PR, Besek MJ. Atraumatic tooth separation and proximal sealing: filling the gap between preventive and restorative dentistry. *Practical Procedures & Aesthetic Dentistry* 2003;**15**:65-69.
27. Schmidlin PR, Beuchat M, Busslinger A, Lehmann B, Lutz F. Tooth substance loss resulting from mechanical, sonic and ultrasonic root instrumentation assessed by liquid scintillation. *Journal of Clinical Periodontology* 2001;**28**:1058-1066.
28. Schmidlin PR, Gohring TN, Sener B, Lutz, F. Resistance of an enamel-bonding agent to saliva and acid exposure in vitro assessed by liquid scintillation. *Dental Materials* 2002;**18**:343-50.
29. Schmidlin PR, Zehnder M, Zimmermann MA, Zimmermann J, Roos M, Roulet JF. Sealing smooth enamel surfaces with a newly devised adhesive patch: a radiochemical in vitro analysis. *Dental Materials* 2005;**21**:545-550.

30. Schmidlin PR, Zehnder M, Pasqualetti T, Imfeld T, Besek, M. Penetration of a bonding agent into de- and remineralized enamel in vitro. *Journal of Adhesive Dentistry* 2004;**6**:111-115.
31. Sideridou ID, Karabela MM, Vouvoudi EC. Volumetric dimensional changes of dental light-cured dimethacrylate resins after sorption of water or ethanol. *Dental Materials* 2008;**24**:1131-1136.
32. Splieth CH, Ekstrand KR, Alkilzy, Clarkson J, Meyer-Lueckel H, Martignon S, Paris S, Pitts NB, Ricketts DN, van Loveren C. Sealants in dentistry: outcomes of the ORCA Saturday Afternoon Symposium 2007. *Caries Research* 2010;**44**:3-13.
33. Wiegand A, Stwarczyk B, Kolakovic M, Hämmerle CH, Attin T, Schmidlin PR. Adhesive performance of a caries infiltrant on sound and demineralised enamel. *Journal of Dentistry* 2011;**39**:117-121.

## Captions

### Figure 1

Results of the sealing ability after different treatments of sound enamel specimens determined as loss of apatite in  $\mu\text{g}$  (box-plot illustration; horizontal bars: medians; boxes: inter-quartile areas; error bars: 10<sup>th</sup> and 90<sup>th</sup> percentiles; dots: extreme values). Identical superscript capitals at the different time points represent no statistically different values.

### Figure 2

Results of the sealing ability after different treatments of artificial enamel lesion specimens determined as loss of apatite in  $\mu\text{g}$  (box-plot illustration; horizontal bars: medians; boxes: inter-quartile areas; error bars: 10<sup>th</sup> and 90<sup>th</sup> percentiles; dots: extreme values). Identical superscript capitals at the different time points represent no statistically different values.

### Figure 3

SEM images at 5'000x of representative samples after different treatments of sound enamel and artificial caries lesions before (baseline) and after 21 days lactic acid exposure.



Figure 1

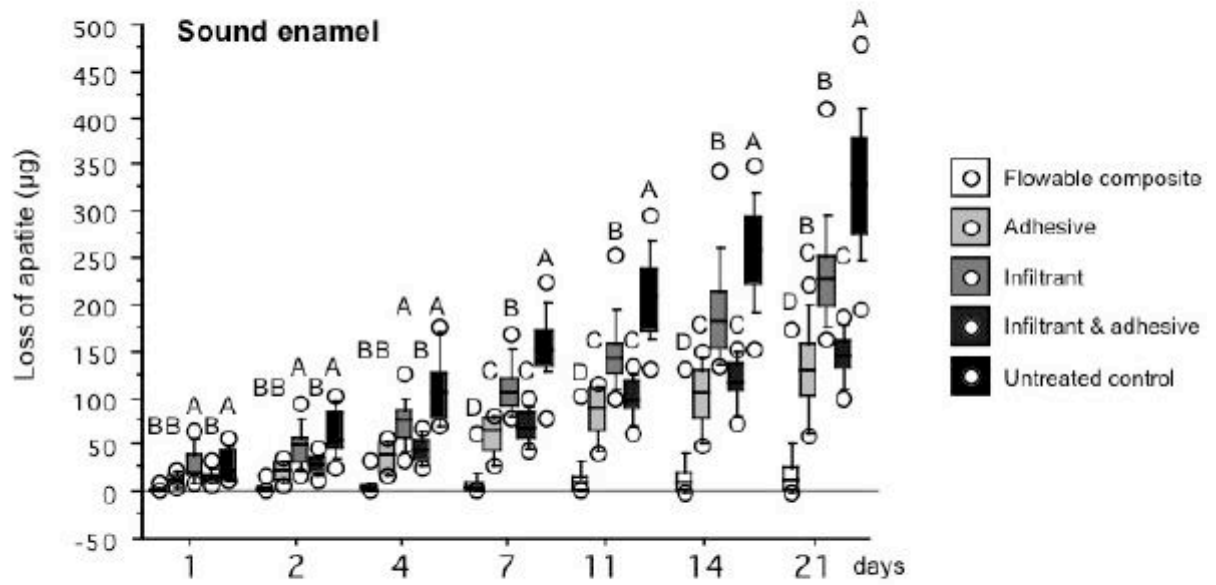


Figure 2

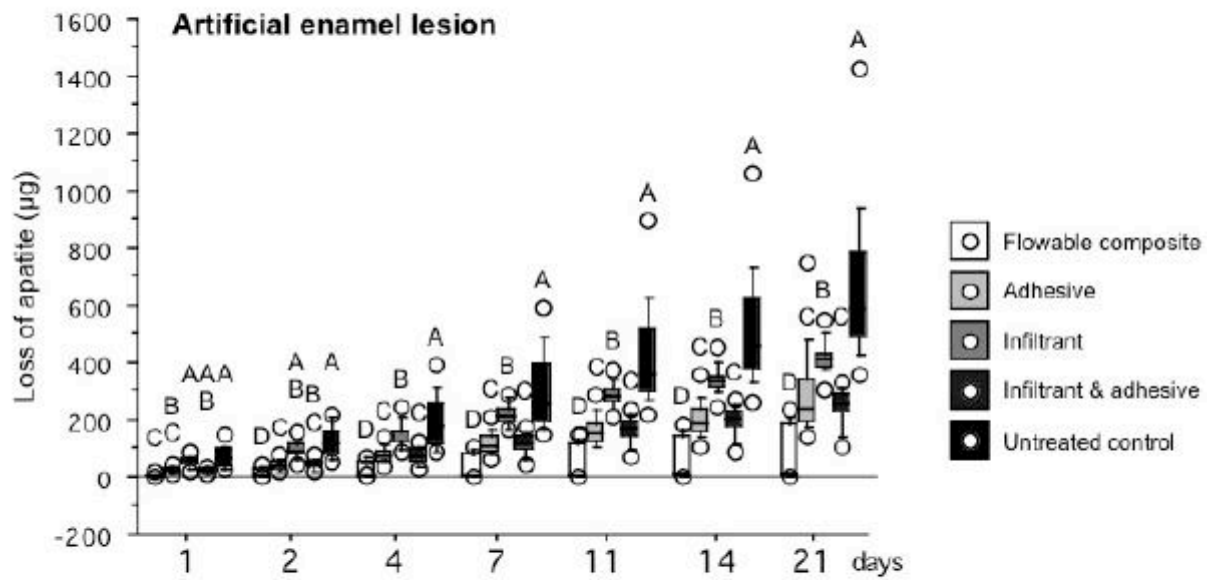
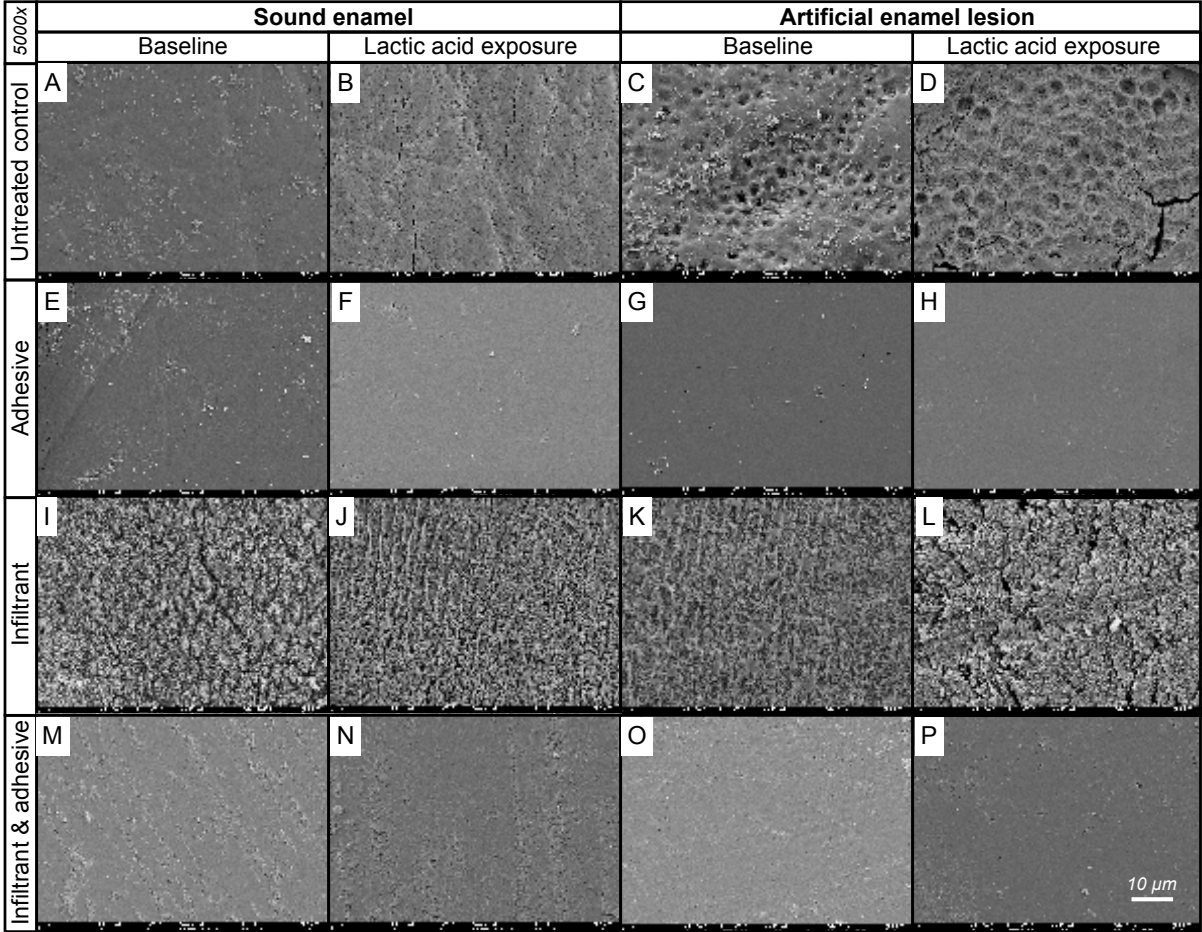


Figure 3



**Table 1**

Composition of the unfilled bonding resin (conventional adhesive) and the low viscosity infiltrant system accordingly to the manufacturers' information.

<b>Product</b>	<b>Composition</b>	<b>Lot number</b>	<b>Manufacturer</b>
<b>Adhesive</b> (Heliobond)	Bis-GMA, TEGDMA, initiators, stabilizers	L24292	Ivoclar Vivadent, Schaan, Liechtenstein
<b>Infiltrant</b> (Icon)	Icon etch: 15% hydrochloric acid, water, pyrogenic silica, tenside, pigments	632178	DMG, Hamburg, Germany
	Icon Dry: ethanol		
	Icon Infiltrant: TEGDMA-based resin		