SrCl₂/HOCl-smear Layer Deproteinization Improves Dentin Bonding Durability of 1-SEAs
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Objective
To evaluate the effect of smear layer deproteinization with HOCl-containing-SrCl₂ solution on dentin bonding durability of one-step self-etch adhesives (1-SEAs).

Methods
Following the ethic approval by the Ethics Committee of Tokyo Medical and Dental University (#2013-022), human dentin surfaces were used to investigate the dentin bonding durability (Fig. 1). The data was analyzed by multifactor ANOVA with Tukey’s post hoc test at a significance level of .05. The failure mode was observed using SEM (JSM-IT100, JEOL, Tokyo, Japan), and analyzed by Pearson’s chi-square test at a significant level of .05.

Table 1 Materials used in this study.

<table>
<thead>
<tr>
<th>Material</th>
<th>Composition</th>
<th>Application</th>
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<tbody>
<tr>
<td>Bond Force II (Tokuyama Dental)</td>
<td>Self-reinforcing phosphoric acid monomer, Bis-GMA, TEGDMA, HEMA, alcohol, water, camphorquinone</td>
<td>1. Apply adhesive and wait for 10s 2. Dry with gentle air for 5s 3. Light cure for 10s</td>
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<tr>
<td>Clearfil Universal Bond Quick (Kuraray Noritake Dental)</td>
<td>10 WMP, Bis-GMA, HEMA, Hydrophilic amide monomer, Colloidal silica, Ethanol, d- Camphorquinone, Accelerators, Water, Sodium Fluoride</td>
<td>1. Apply adhesive with rubbing motion (no waiting time) 2. Dry with gentle air for 5s 3. Light cure for 10s</td>
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<tr>
<td>Clearfil AP-X (Kuraray Noritake Dental)</td>
<td>Bis-GMA, TEGDMA, Camphorquinone, Photoinitiators, Pigments, Silanated barium glass, Silanated silica</td>
<td>1. Apply resin composite in thickness less than 2 mm 2. Light-cure for 10 s 3. Repeat 3 times</td>
</tr>
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</table>

105 ppm Hypochlorous acid (HOCl) (Tokuyama Dental)
Abbreviations: Bis-GMA, 2,2-bis(4-hydroxyphenyl)propane; TEGDMA, triethylene glycol dimethacrylate; HEMA, 2-hydroxyethyl methacrylate; 10 WMP, 10% methacryloyldihydrogen phosphate

Fig. 1 Schematic illustration of microtensile bond strength.

Results
Microtensile bond strength was influenced by the pretreatment (p=.002), adhesive (p<.001) and thermal cycles (p<.001), but not influenced by application time (p=.13). There were significant interactions between the pretreatment agent and adhesive (p<.001), pretreatment agent and thermal cycles (p=.006), and between adhesive and thermal cycles (p=.009). The majority of failure mode was mixed and adhesive failure. There was no significant differences in failure mode distribution (p=1.00)

Discussion
Smear layer deproteinization dissolves organic phase of the smear layer, facilitates adhesive resin infiltration, and enhances chemical interaction hence increase in initial bond strength [1,2]. However, our previous results found that HOCl-smear layer deproteinization could not stabilize dentin bonding durability because its residual oxidizing effect hampers polymerization of adhesive. The incorporation of SrCl₂ could reverse this issue. The absorbed strontium ions on treated dentin surface could promote an interfacial initiation of polymerization of adhesive resin [3], leading to enhancement of dentin bonding durability of 1-SEAs.

Conclusion
The effect of smear layer deproteinization with HOCl-containing-SrCl₂ solution on dentin bonding durability was depend on the concentration of SrCl₂ and adhesive. The incorporation 10% SrCl₂ in HOCl solution could stabilized the dentin bond strength of 1-SEAs.

References

Acknowledgment
This work was supported by the Ministry of Education, Culture, Sports, Science and Technology of Japan (18K09571 and 19K10106).