INTRODUCTION

Conventional indirect restoration requires at least one week after taking an impression to perform a series of processes, including making a stone model, a wax-up model, and a final restoration. A temporary filling material is necessary to protect exposed, intact prepared dentin before the final restoration setting. However, the poor sealing ability and retention of the temporary filling material often causes postoperative sensitivity and pulpal irritation. To reduce these problems, the resin-coating technique, which involves the application of a dentin bonding agent and a flowable resin composite immediately after tooth preparation, was introduced in the 1990s. Moreover, one-bottle adhesives have been used as thin resin-coating materials, especially for crown-prepared teeth. Reports have also suggested that the resin-coating technique not only protects the dentin-pulp complex but also improves the strength of the dentin bond and the internal adaptation of the restoration. Magne et al. also advocated immediate dentin sealing, which is similar to the resin-coating technique, as both the resin-coating technique and immediate dentin sealing produce a hybrid layer and a barrier on the dentin surface.

Computer-aided design/computer-aided manufacturing (CAD/CAM) systems have brought various changes to the dental practice. CAD/CAM systems enable the completion of a treatment from preparation to setting a final restoration in a day without temporary sealing, which is called “single visit treatment.” In a conventional indirect restoration, an oxygen-inhibited layer of the top surface of the resin-coating layer should be removed because the unpolymerized layer damages the surface of impression materials. Moreover, the temporary sealant may result in contamination of the dentin surface and adversely affect the bonding. In contrast, when a CAD/CAM system is used, removing the oxygen-inhibited layer is unnecessary because the intraoral scanner does not directly touch the coated surface. Although the oxygen-inhibited layer is contaminated by saliva prior to cementation, the unpolymerized monomers could contribute to an increased bond strength of resin cement to the resin-coated dentin.

Thus, it is expected that the combination of the resin-coating technique and a single visit treatment can produce a dramatic increase in bond strength. Therefore, the aim of this study was to assess the effect of the resin-coating technique on the bond strength and internal adaptation of CAD/CAM-fabricated inlays. The null hypotheses evaluated in this study were that the resin-coating technique does not affect (1) the bond strength of dual-cure resin cement to dentin and CAD/CAM-fabricated inlay restorations or (2) the internal adaptation of CAD/CAM-fabricated inlay restorations. The materials and methods section of this report will provide details on the study design and methodology.
School and Hospital at Tokyo Medical and Dental University (no. D2013-022). The specimen preparation method is schematically presented in Fig. 1. Seventy-two extracted caries-free human third molars were stored in a storage solution (0.1% thymol) at 4°C until the onset of the experiment. The standardized preparations were applied with nonbeveled mesio-occlusal-distal (MOD) class II cavities using fine diamond burs (Dia-Burs CE-13F, MANI, Tochigi, Japan) (ISO 544/020 5.2/18.9) under constant water cooling. The dimension of the isthmus was 3 mm in depth from the deepest point of the fissure and 4 mm in width. The dimensions were measured using a periodontal probe. All inner cavity angles were rounded, and all surfaces were smoothed. The burs were changed after every 5 preparations.

**Application of the resin-coating technique**

The resin-coating materials used in this study are presented in Table 1. The materials were applied to the entire cavity surface, including the enamel margins. Any excess material was removed prior to light-curing with a light-emitting diode (LED) light-curing unit (VALO, Ultradent, South Jordan, UT, USA) used in “standard mode” (1,000 mW/cm²). The specimens were randomly distributed into 3 groups according to the surface of the cavity treatment as follows.

Uncoated group: The surface of the cavity was left uncoated as a control.

1-step group: A one-bottle adhesive system, G-Premio Bond (G-Premio) (GC, Tokyo, Japan), was used as a resin-coating material. G-Premio was applied to the surface of the cavity, immediately subjected to strong air-drying, and then light-cured for 10 s.

2-step+Flow group: A combination of a two-step self-etch adhesive, Clearfil SE Bond 2 (SE2) (Kuraray Noritake Dental, Tokyo, Japan) and a flowable resin composite, Clearfil Majesty ES Flow (ES flow) (Kuraray Noritake Dental), was used as resin-coating materials. The primer of SE2 was applied for 20 s and air-dried. Then, the bonding agent of SE2 was applied, gently air-dried, and light-cured for 10 s. Afterward, ES flow was thinly placed on the cavity with a disposable applicator brush and light-cured for 20 s.

**CAD/CAM system**

A chairside CAD/CAM system (Planmeca Fit, GC)
Table 1  Resin-coating materials used in this study

| Material                  | Code  | Manufacturer          | Composition                                                                 | Procedure procedure                                      | Batch No. |
|---------------------------|-------|-----------------------|----------------------------------------------------------------------------|----------------------------------------------------------|-----------|
| 1-step                    |       |                       |                                                                            |                                                          |           |
| G-Premio Bond             | G-Premio | GC, Tokyo, Japan     | 10-MDP, 4-MET, methacrylate acid ester, distilled water, 10-MDTP, acetone, photo initiators, silica pH=1.5 | Apply G-Premio, strongly air dry immediately, and then light cure for 10 s. | 1612142   |
| 2-step+Flow               |       |                       |                                                                            |                                                          |           |
| Clearfil SE Bond 2        | SE2   | Kuraray Noritake Dental, Tokyo, Japan | Primer: 10-MDP, HEMA, hydrophilic dimethacrylate, water, photo initiator pH=2.0  
Bond: 10-MDP, HEMA, hydrophobic dimethacrylate, dl-camphorquinone, photo initiators, Bis-GMA, silanated colloidal silica | Apply and leave primer for 20 s and then gently air dry.  
Apply bond, gently air dry, and then light cure for 10 s. | B80054    |
| Clearfil Majesty ES Flow  | ES flow | Kuraray Noritake Dental | Silanated barium glass filler, prepolymerized organic filler, Bis-GMA, hydrophobic aromatic dimethacrylate, dl-camphorquinone | Extend ES flow thinly with a brush and then light cure for 20 s. | BK0083    |

10-MDP: 10-methacryloyloxydecyl dihydrogen phosphate; 4-MET: 4-methacryloxyethyl trimellitic acid; 10-MDTP: 10-methacryloyloxydecyl dihydrogen thiophosphate; HEMA: 2-hydroxyethylmethacrylate; Bis-GMA: bisphenol-A-diglycidyl methacrylate

was employed in this study to produce the inlays. All cavity specimens were scanned with a powder-free intraoral scanner (PlanScan, GC) in accordance with the manufacturer’s recommendations. After scanning, the teeth were stored in distilled water at 37°C for 1 h.

Each MOD inlay was designed using CAD software (PlanCAD Easy Ver. 4.4.1, GC). The design of the restoration was created with the “Pre-op” mode with library “A” for all restorations. The parameters for the spacer and margin thickness were set to 70 and 0 μm, respectively. This image was sent to the CAM system (PlanMill40, GC) to obtain the indirect restoration by milling a CAD/CAM resin block (Cerasmart Shade A2 HT Size 12, GC) in the “detailed” mode. PlanMill40 was equipped with two different milling instruments: a conical bur and a tapered bur. Conical burs were used for less than 120 min before changing, and tapered burs were used for less than 160 min before changing.

Subsequently, the adherent surfaces of the inlays were continuously air-abraded for 10 s using alumina powder with an average particle size of 50 μm (Cobra, Renfert, Hilzingen, Germany) at 0.15 MPa and then ultrasonically cleaned for 3 min in distilled water.

Resin cements and cementation

Each group was further randomly distributed into 3 subgroups according to the dual-cure resin cements, which are presented in Table 2. The application procedures for each cement are described hereafter.

RelyX Ultimate (RXU) (3M ESPE, St. Paul, MN, USA): Scotchbond Universal Etchant (3M ESPE) was applied to the adherent surface of the inlay for 5 s, rinsed with water, and then air-dried. Scotchbond Universal Adhesive (3M ESPE) was applied to both the adherent surface of the inlay and the surface of the cavity, left for 20 s, and gently air-thinned. Afterward, the cavity was light-cured for 10 s.

G-CEM LinkForce (LinkForce) (GC): GC Etchant (GC) was applied to the adherent surface of the inlay for 5 s, rinsed with water, and then air-dried. G-multi Primer (GC) was applied to the surface and strongly air-dried. One drop of G-Premio and one drop of G-Premio Bond DCA (GC) were mixed for 5 s, applied to the surface of the cavity, left for 20 s, and then strongly air-dried.

Panavia V5 (PV5) (Kuraray Noritake Dental): K-Etchant Syringe (Kuraray Noritake Dental) was applied to the adherent surface of the inlay for 5 s, rinsed with water and then air-dried. Afterward, Clearfil Ceramic Primer Plus (Kuraray Noritake Dental) was
| Material          | Code   | Manufacturer                  | Composition                                                                                                                                                                                                 | Procedure                                                                                                                   | Batch No. |
|-------------------|--------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------|
| RelyX RXU         |        | 3M ESPE, St. Paul, MN, USA    | Scotchbond Universal Etchant: 32% phosphoric acid, water                                                                                                                                                     | Block treatment: Apply Scotchbond Universal Etchant syringe for 5 s, rinse with water, and then air dry. Apply Scotchbond Universal Adhesive for 20 s and then gently air dry for 5 s. | 669092   |
|                   |        |                               | Scotchbond Universal Adhesive: 10-MDP, dimethacrylate resins, HEMA, vitrebond copolymer, filler, silane, initiators, ethanol, water pH=2.7                                                                                                                                 | Dentin treatment: Apply Scotchbond Universal Adhesive for 20 s, gently air dry for 5 s, and then light cure for 10 s. | 665025   |
|                   |        |                               | G-CEM LinkForce GC                                                                                                                                  | Place paste from automix syringe and then light cure from 3 directions (occlusal, mesial, and distal) for 20 s each.     | 645829   |
|                   |        |                               | GC Etchant: 37% phosphoric acid, silicon dioxide, colorant                                                                                                                                                     | Block treatment: Apply GC Etchant for 5 s, rinse with water, and then air dry. Apply and leave G-Multi Primer for 20 s and then strongly air dry. | 1702011  |
|                   |        |                               | G-Multi Primer: 10-MDP, 10-MDTP, 3-methacryloyloxypropylmethoxydimethylsilane, ethanol                                                                                                                        | Dentin treatment: Mix a drop of G-Premio Bond and G-Premio Bond DCA for 5 s. Apply and leave the mixed primer for 20 s and then strongly air dry. | 1603112  |
|                   |        |                               | G-Premio Bond: 10-MDP, 4-MET, methacrylate acid ester, distilled water, 10-MDTP, acetone, photo initiators, silica pH=1.5                                                                                     | Place paste from automix syringe and then light cure from 3 directions (occlusal, mesial, and distal) for 20 s each.     | 1603044  |
|                   |        |                               | G-Premio Bond DCA: water, ethanol, initiator                                                                                                        |                                                                                                                              | 1612071  |
|                   |        |                               | G-CEM LinkForce GC                                                                                                                                  |                                                                                                                              |           |
| Panavia V5 PV5    |        | Kuraray Noritake Dental       | K-Etchant Syringe: 35% phosphoric acid, water, colloidal silica, dye                                                                                                                                       | Block treatment: Apply K-Etchant GEL for 5 s, rinse with water, and then air dry. Apply and leave Clearfil Ceramic Primer Plus for 20 s and then gently air dry. | 8P0044   |
|                   |        |                               | Clearfil Ceramic Primer Plus: 3-trimethoxysilylpropyl methacrylate, 10-MDP, ethanol                                                                                                                        |                                                                                                                              | 200035   |
|                   |        |                               | Panavia V5 Tooth Primer: 10-MDP, original multifunctional monomer, new polymerization catalysts, stabilizer, HEMA, water pH=2.0                                                                                   | Dentin treatment: Apply and leave Panavia V5 Tooth primer for 20 s and then gently air dry.                                   | 3N0025   |
|                   |        |                               | Paste A: Bis-GMA, TEGDMA, hydrophobic aromatic dimethacrylate, hydrophilic aliphatic dimethacrylate                                                                                                          | Place paste from automix syringe and then light cure from 3 directions (occlusal, mesial, and distal) for 20 s each.       | 3F0051   |
|                   |        |                               | Paste B: Bis-GMA, hydrophobic aromatic dimethacrylate, hydrophilic aliphatic dimethacrylate                                                                                                                   |                                                                                                                              |           |

10-MDP: 10-methacryloyloxydecyl dihydrogen phosphate; HEMA: 2-hydroxyethyl methacrylate; 10-MDTP: 10-methacryloyloxydecyl dihydrogen thiophosphate; 4-MET: 4-methacryloyloxyethyl trimellitic acid; Bis-GMA: bisphenol-A-diglycidyl methacrylate; UDMA: urethane dimethacrylate; Bis-MEPP: 2,2-bis[4-(2methacryloyloxyethoxy)phenyl]propane; TEGDMA: triethyleneglycol dimethacrylate.
applied to the adherent surface and then gently air-dried. Panavia V5 Tooth Primer (Kuraray Noritake Dental) was applied to the surface of the cavity, left for 20 s, and then gently air-dried.

A thin layer of the mixed cement was applied to the adherent surface of the inlay after the first 1 cm of the mixed cement was discarded. Then, the inlay was seated to the cavity with strong finger pressure. Following the removal of excess resin cement with a cotton pellet, the specimen was light-cured from 3 directions (occlusal, mesial, and distal) for 20 s each using the LED light-curing unit.

**Thermal cycling procedure**

After cementation, all specimens were immersed in water at 37°C for 24 h and subjected to 5,000 cycles in a thermal cycling device (K178-08, Tokyo Giken, Tokyo, Japan) at 5 and 55°C with an immersion time of 30 s and a transfer time of 2 s.

After thermal cycling, each specimen was sectioned mesiodistally with a low-speed diamond saw (Isomet, Buehler, Lake Bluff, IL, USA) to provide two half-specimens. One half-specimen was used for microtensile bond strength (MTBS) testing, and the other half-specimen was used for the evaluation of internal adaptation.

**MTBS testing**

The specimens were cross-sectioned longitudinally with the low-speed diamond saw to produce 1.0×1.0 mm² beam-shaped sticks. Six beams were obtained from each specimen, adding up to forty-eight beams per group. Before MTBS testing, the dimensions of each beam were checked using a digital caliper (Mitutoyo CD-15C, Mitutoyo, Kanagawa, Japan) with a ±0.1 mm accuracy. Subsequently, a universal testing machine (EZ-SX, Shimadzu, Kyoto, Japan) was used to assess the MTBS at a crosshead speed of 1 mm/min after each specimen was fixed to a customized microtensile jig using cyanoacrylate adhesive (Model Repair II Blue, Dentsply-Sankin, Tokyo, Japan).

**Failure modes**

After the MTBS testing, the fractured specimens were placed horizontally in epoxy resin (EpoxiCure 2, Buehler). After the resin was cured for 24 h, the resin-embedded specimens were polished with a sequence of wet silicon carbide papers (600-, 800-, 1000-, 1200-, 1500-, and 2000-grit) and diamond pastes (6, 3, 1, and 0.25 μm). After finishing, the specimens were ultrasonically cleaned for 3 min in distilled water. The internal adaptation of the restorations and the thicknesses of the resin-coating and resin cement layers were assessed via confocal laser microscopy (CLSM) (VK-X150, Keyence, Osaka, Japan) under 480× magnification. It was considered a “continuous margin” if a gap was not detected between different layers (i.e., dentin, resin-coating layer, resin cement, and CAD/CAM resin block) with CLSM under 20× objective lens. The percentage of “continuous margin” was calculated by the ratio of the “continuous margin” length to the entire margin length. The thickness of the resin-coating layer and resin cement at the center of the cavity wall (wall), cavity corner (corner), and cavity floor (floor) were measured using automatic multifile analysis software (VK-H1XM, ver.1.3.1.120, Keyence).

**Statistical analysis**

As the distribution of the data fitted the presumption of normality (Kolmogorov-Smirnov test), the MTBS test data were statistically analyzed by two-way ANOVA followed by Tukey’s test. Internal adaptation data were statistically analyzed by the Kruskal-Wallis H test. All statistical analyses were performed using the statistical software SPSS version 23 (IBM, Chicago, IL, USA) with the statistical significance set to 0.05.

**RESULTS**

**MTBS test**

The results of the MTBS tests are presented in Table 3. Two-way ANOVA indicated that two factors, “resin coating” and “resin cement”, influenced MTBS (p<0.001). A significant interaction was identified between these two factors (p<0.05). For the uncoated group, the results of the MTBS tests for RXU were statistically higher than those for LinkForce and PV5 (p<0.05). For the 1-step group, there were no significant differences between RXU and LinkForce or between RXU and PV5 (p>0.05). For the 2-step+Flow group, there were no significant differences between RXU and LinkForce or between LinkForce and PV5 (p>0.05). For RXU, there were no
Table 3  Microtensile bond strengths of resin cement to dentin and CAD/CAM-fabricated inlay (MPa)

|                  | Uncoated         | 1-step           | 2-step+Flow       |
|------------------|------------------|------------------|-------------------|
| RXU              | 37.1±12.4\textsuperscript{A} | 35.7±11.5\textsuperscript{A,b,c} | 34.3±12.5\textsuperscript{A,d} |
| LinkForce        | 25.2±15.8\textsuperscript{a} | 37.3±13.7\textsuperscript{B,b} | 38.2±12.6\textsuperscript{B,d,e} |
| PV5              | 21.5±12.0\textsuperscript{a} | 32.4±10.6\textsuperscript{c} | 40.9±13.1\textsuperscript{e} |

All values are given as the mean± SD. Within the same column, the values with the same small superscript letter are not significantly different (p>0.05). Within the same row, the values with the same capital superscript are not significantly different (p>0.05).

significant differences in MTBS among the uncoated, 1-step, and 2-step+Flow groups (p>0.05). For LinkForce, there were significant differences between the uncoated and 1-step groups and the uncoated and 2-step+Flow groups (p<0.05). However, there were no significant differences between the 1-step and 2-step+Flow groups (p>0.05). For PV5, there were significant differences among the uncoated, 1-step and 2-step+Flow groups (p<0.05).

Failure modes
The failure mode results are presented in Fig. 2. Representative SEM images of the specimens are shown in Fig. 3 (a–f). For the uncoated group, the predominant
Table 4  Percentages of the “continuous margin” at each interface

|                  | Uncoated                      | 1-step           | 2-step+Flow       |
|------------------|-------------------------------|------------------|-------------------|
|                  | Block/cement/Cement/dentin    | Block/cement     | Block/cement      |
| RXU              | 100±0.0                       | 100±0.0          | 100±0.0           |
| LinkForce        | 100±0.0                       | 95.4±13.7        | 97.5±5.2          |
| PV5              | 100±0.0                       | 98.5±4.4         | 100±0.0           |

All values are given as the mean±SD.
No statistically significant difference was found among the experimental groups.

Table 5  Thicknesses of the resin-coating layers and the cements (μm)

|                  | Wall          | Corner       | Floor         |
|------------------|---------------|--------------|---------------|
| G-Premio         | 12.8±6.4      | 7.5±4.5      | 9.0±6.3       |
| SE2              | 11.1±12.3     | 11.3±10.9    | 7.8±7.0       |
| ES flow          | 80.1±61.8     | 88.6±72.9    | 41.8±28.4     |
| RXU              | 169.2±40.0    | 273.8±91.7   | 255.3±104.0   |
| LinkForce        | 196.2±113.8   | 263.1±100.3  | 275.2±91.1    |
| PV5              | 168.7±52.7    | 289.1±136.2  | 308.7±122.5   |

All values are given as the mean±SD.

Fig. 4  Representative CLSM images of the specimens are shown in Figs. 4 (a, b). The percentage of “continuous margin” was 100% in all groups except the 1-step group of LinkForce and PV5 between the CAD/CAM resin block and resin cement and the 2-step+Flow group of LinkForce between the CAD/CAM resin block and resin cement. However, no significant differences were revealed among the groups (p>0.05).

Resin-coating layer and cement thickness
The thicknesses of the resin-coating layer and the cement are summarized in Table 5. For the resin-coating layer, the mean thicknesses of G-Premio and SE2 were approximately 10 μm, and the mean thickness of ES flow ranged from 41.8 to 88.6 μm. Similar thicknesses were observed for all resin cements. However, the thickness of the cement layer tended to be thinner in the wall area than in the cavity corner and on the floor.

DISCUSSION
In the uncoated group, RXU exhibited much higher bond strength than that of LinkForce and PV5. According to the manufacturers’ instructions, the pretreatment process of the dentin surface was different for each cement. RXU was the only cement for which adhesive was applied as a pretreatment for dentin and separately light-cured before luting the CAD/CAM-fabricated inlay. Independent light activation of the adhesive layer contributed to acquiring better crosslinking and an improved degree of conversion in the Scotchbond Universal Adhesive. This phenomenon was presumably the reason that RXU
exhibited a prominent bond strength in the uncoated group.

In the literature, PV5 exhibited excellent performance in terms of dentin bonding even under insufficient or absence of light exposure\(^{16,17}\). In addition, both self-cured and dual-cured PV5 exhibited considerably less water sorption than other dual-cure resin cements, such as RXU\(^{18}\). Contrary to the results of previous study\(^{17}\), PV5 exhibited lower bond strength than RXU in the uncoated group in the current study, which could be attributed to the different pretreatment used for RXU and PV5. RXU and LinkForce employ adhesive resins for pretreatment of both the dentin surface and the CAD/CAM resin block. In contrast, PV5 employs Panavia V5 Tooth Primer for pretreatment of the dentin surface and Clearfil Ceramic Primer Plus for pretreatment of the CAD/CAM resin block. We speculate that the adhesive resin used in RXU and LinkForce could have created a low elastic modulus layer that worked as a stress breaker or a shock absorber\(^{19}\), thus resulting in higher bond strengths than those of PV5. Another possible reasons for this finding could be the influence of thermal cycling and the configuration factor (C-factor).

Thermal cycling is one of the most widely employed procedures to imitate clinical situations\(^{20}\). Thermal cycling may cause stress both within a material and between interfaces in a bonded specimen as a result of the different thermal expansion coefficient, thermal conductivity, and water sorption characteristics of materials. The condition used in the current study (i.e., 5,000 cycles between 5 and 55°C) may simulate approximately one half-year of oral service\(^{21}\). Regarding the internal adaptation results, more than 95% "continuous margin" was observed in all groups. Because a gap of less than 1 μm was not detected and the materials expanded with absorbed water\(^{22}\), it was likely that the gap might not be detected.

Regarding the influence of C-factor, previous studies were conducted with flat dentin surfaces\(^{16,17}\), whereas a class II cavity was prepared in this study, resulting in a higher C-factor. This phenomenon could have caused substantial polymerization contraction stresses, which were generated by cement shrinkage stresses after polymerization. Polymerization contraction stresses could be propagated along the interface between the restoration and the cavity walls\(^{23-25}\), possibly affecting the bond strength and internal adaptation.

Polymerization contraction stresses caused by C-factor become more susceptible as the cement thickness increases\(^{26}\). In the current study, the mean thickness of resin cement varied from 168.7 to 308.7 μm. May et al. stated that pre cementation spaces of approximately 50–100 μm were encouraged, and the advantages obtained from the bonding were lost at approximately 450–500 μm because of polymerization shrinkage stresses\(^{26}\). The thickness and the properties of the cement layer are crucial factors affecting the failure behavior of tooth-colored restorations\(^{27}\). It has been emphasized that a small volume of resin cement is preferable to diminish stress generation due to polymerization shrinkage of the resin cement\(^{28}\). However, the thicknesses of the cement layers were not significantly different among the cements used in the current study.

Resin coating often improved the bond strength of resin cement in the current study. The 1-step groups exhibited higher bond strength than the uncoated group in LinkForce and PV5. In addition, the 2-step+Flow group exhibited higher bond strength than the uncoated and 1-step groups in PV5. These results were consistent with those in previous studies. Nikaido et al. revealed that resin coating with a one-bottle adhesive improved the bond strength of resin cement\(^{29}\). Okuda et al. and Akehashi et al. revealed that resin coating with a dentin bonding system and a flowable composite resin improved the bond strength of resin cement\(^{6,29}\). Medina et al. reported that resin coating with a 2-step self-etch adhesive and a flowable composite achieved higher bond strength than that of resin coating with a one-bottle adhesive\(^{30}\) because the relatively hydrophilic adhesive covered by a hydrophobic flowable composite acted as a physical barrier to the percolation of water through the adhesive layer\(^{31}\).

However, resin coating did not improve the bond strength of RXU, and the 2-step+Flow group did not exhibit a higher bond strength than the 1-step group in LinkForce in the current study. Takahashi et al.\(^{4}\) investigated four one-bottle adhesives as resin-coating materials in conjunction with resin cements from the same manufacturers. Whether a single application of a one-bottle adhesive improved the dentin bond strength seemed dependent on the material. However, it was reported that the dual-application of a one-bottle adhesive improved dentin bond strength. For the 1-step group in RXU and LinkForce, G-Premio was applied and light-cured as a resin coating. After 1 h of storage in water, Scotchbond Universal Adhesive or a mixture of G-Premio and G-Premio Bond DCA was applied as a pretreatment for cementation. After application of a resin coating with 1 step, an oxygen-inhibited layer that was produced at the top of the resin-coating layer was not removed in the current study; hence, this situation was similar to that of the dual-application of resin coating. This finding was a feasible reason for the results that the 1-step and 2-step+ Flow groups exhibited similar bond strengths in RXU and LinkForce. It was also conceivable that the uncoated group with RXU achieved prominent bond strength, as Scotchbond Universal Adhesive acted as a resin coating with a single application of one-bottle adhesive.

Therefore, the first null hypothesis investigated in this study was partially rejected since each resin cement influenced resin coating differently. Even if resin coating did not improve the bond strength, adhesive failure at the dentin interface was rarely observed in the groups with resin coating. This finding indicated that the dentin surface was protected by resin coating when a CAD/CAM restoration was debonded or fractured. On the other hand, the second null hypothesis was accepted because no significant differences in internal adaptation were identified.
CONCLUSIONS
The application of a resin coating consisting of only a one-bottle adhesive or a combination of a two-step self-etch adhesive and a flowable resin composite affected bond strength. However, the influence of resin coating was dependent on the resin cement. Resin coating with a combination of a two-step self-etch adhesive and a flowable resin composite might be more effective than resin coating with a one-bottle adhesive. Regarding internal adaptation, no differences were found among all tested groups.

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