Does a Self-adhesive Flowable Resin Composite Perform Similarly to Highly Filled and Conventional Flowable Resin Composites in Occlusal Cavities? A 2-year Follow-up Study

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Purpose: The aim of this clinical trial was to compare a self-adhesive flowable resin composite, a highly filled flowable resin composite used in combination with a universal adhesive applied in self-etch mode, and a conventional flowable resin composite used in combination with a universal adhesive applied using two different application modes in occlusal cavities.

Materials and Methods: Twenty-eight patients received 114 occlusal restorations. Cavities were divided into four groups: CS: a self-adhering flowable (Constic, DMG); GF: a highly filled flowable (G-ænial Universal Flo, GC) in combination with a universal adhesive applied in self-etch mode (G-Premio Bond, GC); TF-SE: a conventional flowable (Tetric N-Flow, Ivoclar Vivadent) in combination with a universal adhesive (Tetric N-Bond Universal, Ivoclar Vivadent) applied in self-etch mode; TF-ER: a conventional flowable (Tetric N-Flow, Ivoclar Vivadent) in combination with a universal adhesive (Tetric N-Bond Universal, Ivoclar Vivadent) applied in etch&rinse mode. Restorations were scored using modified USPHS criteria. Descriptive statistics were performed using chi-squared tests.

Results: At 24-month evaluations, none of the restorations were lost. The CS group showed significantly higher bravo scores for marginal adaptation than did the other experimental groups ($p = 0.024$). Significant changes were seen for CS and GF regarding marginal adaptation compared to baseline.

Conclusion: Although the self-adhering flowable resin composite exhibited inferior marginal adaptation compared to the highly filled flowable and conventional flowable resin composites, the restored teeth demonstrated a clinically acceptable performance after 24 months.

Keywords: adhesive, dental materials, clinical research, resin composite.

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Minimally invasive dentistry has become more popular in developed societies due to increased standards of dental care. As the importance of dental hygiene is increasingly emphasized during routine dental examinations, the caries incidence and lesion size are decreasing, enabling treatment with minimally invasive techniques.[1,2] Because caries occurs more frequently in the pits and fissures of posterior teeth, the selection of restorative materials that remain intact in the long term is important to prevent fissures from demineralization.[2,3]

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The conservative restoration of class I cavities is conducted primarily with conventional resin composites.[8] These materials have a high elastic modulus and low flowability, giving them low stress relaxation rates. However, these resin composites can be difficult to work with in small cavities.

Flowable resin composites, valued for their esthetic characteristics and high flowability, were introduced in the 1990s[6] and have been used widely to restore small to moderately sized cavities. They have good handling properties when delivered through a syringe tip, which enables the resin composite to spread to inaccessible areas.[1] Although flowable resin composites have better adaptation to inner walls, the simplification of their use is an ongoing challenge[2,8] and their application is limited because of mechanical limitations.[7] As a result, flowable resin composites are applied primarily in locations subject to minimal occlusal force, such as class V lesions or small class I and II cavities.

The first generation of flowable resin composites was filled at concentrations ranging from 50 wt% to 70.5 wt%.[6] Increases of the filler content of flowable resin composites were found to improve the mechanical properties and reduce the polymerization shrinkage of the materials.[13,16] This im-

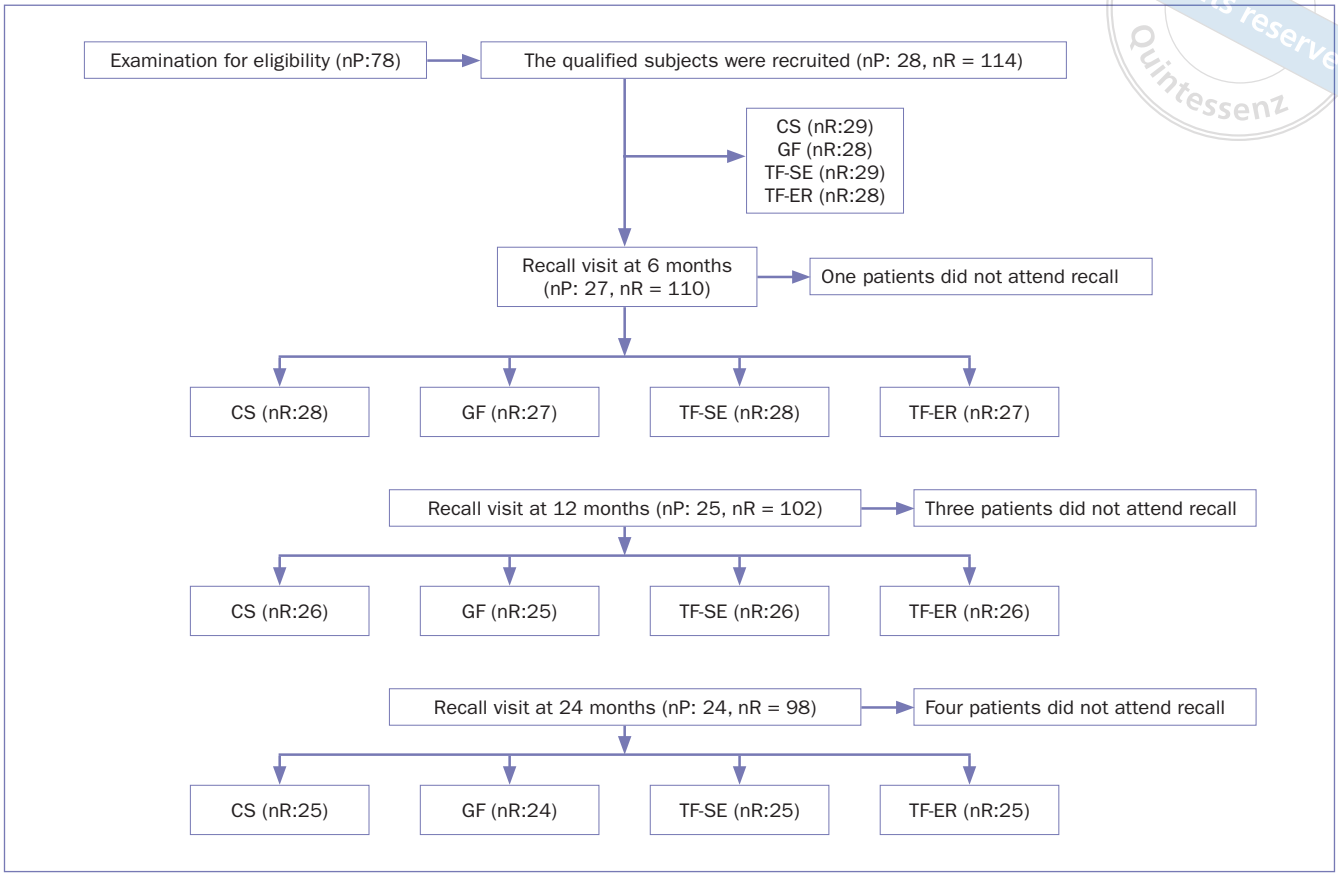

Fig 1 Flow diagram of the study. CS: Constic, GF: G-aenial Universal Flo, TF-SE: Tetric N-Flow in combination with Tetric N-Bond Universal in self-etch mode, TF-RE: Tetric N-Flow in combination with Tetric N-Bond Universal etch&rinse mode.

provement is important because polymerization shrinkage can lead to marginal gaps and leakage around the tooth and, ultimately, under the restoration. An in vitro study[8] demonstrated that the placement of a flowable resin composite in occlusal cavities led to increased leakage compared with the use of a conventional resin. Baroudi et al[5] showed that flowable resin composites with higher filler concentrations underwent less shrinkage-related strain.

Recent developments in adhesive and esthetic dentistry have enabled the incorporation of adhesives into flowable resin composites. Self-adhering resin composites were introduced to overcome the complications of multiple-step procedures and facilitate clinical placement.[14] Self-adhering resin composites do not require separate bonding and eliminate the need for adhesive application.[14] They are practical to use and can be applied quickly, making them advantageous in clinical practice. Accordingly, the use of self-adhering flowable resin composites during a single visit is preferable for uncooperative patients.[7]

Recently, a new self-adhering flowable resin composite, Constic (DMG; Hamburg, Germany), was introduced. Although this material has been examined in a few in vitro studies,[19,21] no clinical study has been conducted. In one in vitro study, Constic exhibited lower shear bond strength than did a conventional flowable resin composite used with an etch-and-rinse adhesive.[19]

Therefore, the aim of this clinical study was to evaluate and compare the 24-month clinical performance of the new self-adhering flowable resin composite as compared to a highly filled flowable resin composite used in combination with a universal adhesive applied in self-etch mode, and a conventional flowable resin composite used with a universal adhesive in self-etch and etch-and-rinse modes to restore occlusal cavities. The null hypothesis was that no differences among the groups would be observed.

MATERIALS AND METHODS

The experimental protocol for this study followed the Consolidated Standards of Reporting Trials and was registered at ClinicalTrials.gov (NCT04324008). Ethical approval for the study was granted by the Institutional Clinical Investigations Ethics Committee (no. KA-19023) of Hacettepe University, Ankara, Turkey. All participants signed a written informed consent form.

Table 1 Inclusion and exclusion criteria for participants

Inclusion criteria	Exclusion criteria
a) Age: 18 years or older b) No medical or behavioral problems preventing attendance at review treatments c) At least 28 teeth present d) At least 4 vital teeth with occlusal caries*	a) Poor gingival health b) Uncontrolled, rampant caries c) Bruxism d) Xerostomia

*Occlusal caries which scored as 3 according to ICDAS II criteria were included.

Patient Screening

Figure 1 shows a flow chart of the study design. Participants who met the inclusion criteria were recruited after undergoing clinical and radiographic examinations as part of routine dental care at the Restorative Dentistry Department. Two experienced clinicians assessed the eligibility of 78 patients. The examinations were carried out using an explorer and a mouth mirror. Twenty-eight patients (20 women, 8 men) with a mean age of 21 (range 18–26) years met the criteria and were selected for inclusion in the study.

The inclusion criteria were age ≥ 18 years, presence of ≥ 28 teeth, absence of any medical or behavioral problem that would prevent attendance of follow-up appointments, and presence of ≥ 4 vital teeth with occlusal caries. The exclusion criteria were poor gingival health, xerostomia, bruxism and uncontrolled, rampant caries (Table 1). After radiological and clinical examinations, only patients with occlusal caries were included in the study. In addition, tooth vitality was checked to avoid the inclusion of non-vital teeth. No included tooth had a previously placed restoration or pulpal or periapical pathology, and all included teeth were vital.

Randomization

A clinician who was not involved in the study performed randomization. The teeth were randomized to one of the four restorative treatments using a table of random numbers generated by the Research Randomizer program (http://www.randomizer.org/form.htm). Similar numbers of teeth were allocated to the four types of restoration, and each patient received at least four restorations, one from each of the study groups. In some cases, more than one occlusal lesion was restored following the same randomization protocol.

Restorative Treatments

The materials used in this study are listed in Table 2. Before the restorative procedures, the teeth were cleaned using a rotating rubber cup in a slow-speed handpiece, then rinsed and dried. All included teeth had occlusal caries with a score of 3 according to ICDAS II (International Caries Detection and Assessment System) criteria.[18] The teeth were prepared using diamond fissure burs attached to a high-speed handpiece with water-spray cooling. A round stainless-steel bur on a slow-speed handpiece was used to remove the caries. If patients complained about discomfort or pain, local anesthesia was applied during the restorative procedures. Cavities were randomly assigned to the different restorative system treatments. All restorations were performed according to the manufacturers' instructions.

The groups were: CS: treated with a self-adhering flowable resin composite (Constic, DMG); GF: treated with a highly filled flowable resin composite (G-ænial Universal Flo, GC; Tokyo, Japan) in combination with a universal adhesive (G-Premio Bond, GC) applied in self-etch mode; TF-SE: treated with a conventional flowable resin composite (Tetric N-Flow, Ivoclar Vivadent; Schaan, Liechtenstein) in combination with a universal adhesive (Tetric N-Bond Universal, Ivoclar Vivadent) applied in self-etch mode; and TF-ER: treated with a conventional flowable resin composite (Tetric N-Flow, Ivoclar Vivadent) in combination with a universal adhesive (Tetric N-Bond Universal; Ivoclar Vivadent) applied in etch-and-rinse mode. All materials were applied according to the manufacturers' instructions (Table 2). The restorative procedures were performed after the cavities had been isolated using cotton rolls.

All restorations were finished using fine finishing diamond burs in a high-speed handpiece under water-spray cooling, and then polished with a rubber cup (Identoflex Composite Polisher, yellow, Kerr; Orange, CA, USA) attached to a slow-speed handpiece.

One operator performed all restorations. The operator had >8 years of experience, and performed 10 restorations with each tested material on patients not included in the study before the start of the trial. Each restoration was scored as Alpha at baseline by the two previously calibrated evaluators.

Clinical Evaluation

Before starting the assessments, two experienced examiners who were not the operator were trained to maximize intra-examiner and inter-examiner reliability. The interexaminer agreement rates were ≥85%. The examiners were blinded to group assignment and performed the examinations independently, using mirrors and probes. The patients were also blinded to the restorative method used for each tooth. The examiners were required to reach consensus before each participant was dismissed.

The restorations were evaluated at baseline (1 week after placement) and at 6, 12, and 24 months after placement. Retention, marginal adaptation, marginal discoloration, surface texture, postoperative sensitivity, and secondary caries were assessed according to the modified United States Public Health Service (USPHS) criteria.

Table 2 Materials used in the study

Material / Manufacturer	Composition	Application
Constic / DMG; Hamburg, Germany	Methacrloxydecyl dihydrogen phosphate (MDP), bisphenol A-glycidyl methacrylate, ethoxylated bisphenol A dimethacrylate (EBADMA), urethane dimethacrylate, 2-hydroxy ethyl methacrylate (HEMA), triethylene glycol dimethacrylate (TEG-DMA), and 1,6-hexanediol dimethacrylate (HDMA)	Constic was applied using a dispensing tip. A brush was used to apply resin composite to the entire cavity with pressure for 15-20 s and a thin layer was obtained. Excess material was removed around margins with the brush, if necessary. Resin composite was light cured using a LED light-curing unit (1200 mW/cm^2) for 20 s. After lining the cavity wall with resin composite, the restoration was built and light cured for 20 s.
G-Premio Bond / GC; Tokyo, Japan	Methacrloxydecyl dihydrogen phosphate (MDP), acetone, dimethacrylate, phosphoric acid ester monomer, photoinitiator, butylhydroxytoluene (BHT), methacryloyloxydecyl dihydrogen thiophosphate (MDTP)	G-Premio Bond was applied to the surfaces using an applicator brush and left undisturbed for 10 s. Adhesive was dried thoroughly for 5 s with air under maximum air pressure and light-cured with for 10 s.
G-ænial Universal Flo / GC	Urethane dimethacrylate (UDMA), bis-MEPP, TEG-DMA, silicon dioxide, strontium glass, pigment, photo-initiator	G-ænial Universal Flo was placed using a dispensing tip and light cured for 20 s.
Tetric N-Flow / Ivoclar Vivadent; Schaan, Liechtenstein	Urethane dimethacrylate, bis-GMA (bisphenol A-glycidyl methacrylate), 2 ytterbium trifluoride, triethylene glycol dimethacrylate	Tetric N-Flow was placed and light cured for 10 s.
Tetric N-Bond Universal / Ivoclar Vivadent; Schaan, Liechtenstein	2-hydroxyethyl methacrylate, bis-GMA (bisphenol A-glycidyl methacrylate), ethanol, 1,10-decandiol dimethacrylate, methacrylated phosphoric acid ester, camphorquinone, 2-dimethylaminoethyl methacrylate	Self-etch mode: Tetric N-Bond Universal was applied to the cavity surfaces (scrubbing) for 20 s, dried with air until a glossy, immobile film layer was formed and light cured for 10 s. Etch&rinse mode: Phosphoric acid (N-Etch, Ivoclar Vivadent) (37%) gel was applied onto enamel first, then dentin. The etchant was left to react on the enamel for 30 s and dentin for 15 s. After the acid gel was rinsed thoroughly with a vigorous stream of water for 5 s, the cavity was dried with compressed air until the etched surfaces appeared chalky white. Tetric N-Bond Universal was applied to the cavity surfaces (scrubbing) for 20 s and dried with air until a glossy, immobile film layer was formed and light cured for 10 s.

Statistical Analysis

The groups were compared using the Pearson chi-squared test. Baseline and follow-up scores were compared using Cochran's Q test followed by McNemar's test with Bonferroni correction for pairwise comparisons. All statistical analyses were performed using IBM SPSS 22.0 (IBM; Armonk, NY, USA). The significance level was set at 0.05.

RESULTS

One hundred fourteen restorations were placed in 28 patients. Fifty-eight (51%) restorations were placed in maxillary teeth and 56 (49%) restorations were placed in mandibular teeth. Of the restorations, 44 (39%) were placed in first molars, 60 (53%) in second molars, 5 (4%) in first premolars, and 5 (4%) were placed in second premolars (Table 3). The recall rates for the 6-, 12-, and 24-month follow-up assessments were 96%, 89%, and 85%, respectively. The results of the clinical assessments are provided in Table 4. The retention rate was 100% at all evaluation timepoints in all groups. A total of four patients did not attend follow-up assessments. One patient reported that she was not available to visit the hospital at 6 months, and two patients could not be reached by telephone at 12 months, and one patient had moved to another city at 24 months.

Eight (30.8%) restorations in group CS, four (16%) restorations in group GF and two (7.7%) restorations in group TF-SE were scored as bravo for marginal adaptation at the 12-month recall. The rate of bravo scores for marginal adaptation at 12 months was significantly higher in the CS group than in the other groups ($p < 0.05$). At the 24-month examination, nine (36%) restorations in group CS, six (25%) in group GF, three (12%) in group TF-SE and one (4.2%) restoration in the TF-ER group were scored as bravo for marginal adaptation. The number of bravo scores was significantly higher in the CS group than in the other groups ($p < 0.05$).

Three (12%) restorations in group CS, one (4.2%) in group GF, and one (4%) restoration in group TF-SE were scored as

bravo for marginal discoloration. No significant difference was detected among groups at 24 months ($p > 0.05$).

Two (8%) restorations in the CS group and one (4.2%) restoration in the GF group received bravo scores for color matching. However, no significant difference was seen among groups ($p > 0.05$). All restorations received alpha scores for surface texture, postoperative sensitivity, and secondary caries.

Cochran's Q test followed by McNemar's showed a significant change in marginal adaptation over time in group CS at 12 and 24 months (both $p = 0.001$). Additionally, group GF showed a significant change in marginal adaptation at 24 months ($p = 0.008$).

Discussion

The present study was performed to compare the performance of three flowable resin composites applied to occlusal cavities. All restored teeth showed acceptable clinical performance at the 24-month follow-up assessment. However, the marginal adaptation of the conventional and highly filled flowable resin composites was superior to that of the self-adhering flowable resin composite at 12 and 24 months ($p < 0.05$). In addition, restorations conducted with the self-adhering and highly filled flowable resin composites applied with a universal adhesive in self-etch mode were significantly more likely to have a bravo score for marginal adaptation at 24 months. No significant difference in any criterion was observed over time for the conventional flowable resin composite. Thus, the null hypothesis was rejected. The conventional resin composite was chosen as a control for comparison with the contemporary and relatively new self-adhering and highly filled flowable resin composites. The highly filled flowable resin composite was used with its own adhesive in the present study. The conventional flowable resin composite was also used with its own adhesive, in two different application modes. For comparison of the retention ability of the self-adhering flowable resin composite, a group treated with the conventional flowable resin composite and etch-and-rinse adhesive (TF-ER) was included. The adhesion of resin to enamel depends on the method of acid application on the enamel, the etching time, and the concentration of the acid.[3,9] A standard time of 15–20 s is generally recommended.[28] Although the enamel was not acid etched in three groups in the present study, all groups had successful retention rates and no restoration failed. However, a previous in vitro study[21] demonstrated that Constic (DMG) had lower dentin shear bond strength than did Tetric N-Flow (Ivoclar Vivadent) applied in combination with a self-etch adhesive (Tetric N-Bond, Ivoclar Vivadent). In addition, Peterson et al[13] reported that self-adhesive composites (Constic, DMG; Fusio Liquid Dentin, Pentron; and Vertise Flow, Kerr) had low enamel and dentin microtensile bond strengths. Furthermore, Constic (DMG) had lower shear bond strength than did a conventional flowable resin composite (Venus Diamond Flow, Heraeus Kulzer; Hanau, Germany) used in combination with an etch-and-rinse adhesive (OptiBond FL, Kerr).[19]

Table 3 Distribution of occlusal restorations according to tooth type and arch

	Number of occlusal restorations Total n (%)
Arch distribution	
Maxillary	58 (51)
Mandibular	56 (49)
Tooth distribution	
First premolars	5 (4)
Second premolars	5 (4)
First molars	44 (39)
Second molars	60 (53)

As they lessen chairside time, self-adhering flowable resin composites represent an advance in dentistry for the treatment of uncooperative patients.[26] A short treatment time is more comfortable for all types of patients and is preferred by dentists in a variety of situations, provided that the outcomes and restoration longevity are comparable to those achieved with the use of traditional methods. Flowable resin composites have less filler loading and contain larger proportions of diluent monomers than do traditional resin composites.[25] The low filler loading of early-generation flowable resin composites reduced the wear resistance of restorations. The inferior mechanical properties of these flowable resin composites led clinicians to select conventional resin composites for the treatment of cavities with high-stress occlusal function, as filler particles protect the resin matrix during abrasive wear.[4]

Self-adhering flowable resin composites combine resin-composite and adhesive resin technology by incorporating the bonding agent into the flowable resin composite. Chemical and micromechanical interactions between the material and tooth structure generate adhesion properties, and the material relies on this bond.[29] The characteristics of this material make it suitable for pit-and-fissure sealing, and the material has been used as a fissure sealant in many studies.[11,15,20] Data on the use of flowable resin composites in posterior teeth are limited, but self-adhering and conventional flowable resin composites have demonstrated acceptable clinical results after 6 months.[24,27] In a clinical trial, a flowable composite with a high filler content showed acceptable clinical behavior, similar to that of a conventional composite resin, in class II restorations after 2 years of service.[22]

In the present study, all flowable resin composites were placed in a minimally invasive manner in class I cavities, and their clinical performance over 2 years was compared. To our knowledge, no previous clinical study has examined the performance of three different flowable resin composites in occlusal cavities. Wadhwa et al[28] compared the performance of a self-adhering flowable resin composite (Dyad Flow, Kerr) and a resin-based fissure sealant in a clinical

Table 4 Clinical evaluation outcomes of the restorations

Evaluation criteria	Score	Baseline n (%)				6-month n (%)				12-month n (%)				24-month n (%)			
		CS (29)	GF (28)	TF-SE (29)	TF-ER (28)	CS (28)	GF (27)	TF-SE (28)	TF-ER (27)	CS (26)	GF (25)	TF-SE (26)	TF-ER (25)	CS (25)	GF (24)	TF-SE (25)	TF-ER (24)
Retention	Alpha	29 (100)	28 (100)	29 (100)	28 (100)	28 (100)	27 (100)	28 (100)	27 (100)	26 (100)	25 (100)	26 (100)	25 (100)	25 (100)	24 (100)	25 (100)	24 (100)
	Bravo																
	Charlie																
Marginal adaptation	Alpha	29 (100)	28 (100)	29 (100)	28 (100)	24 (85.7)	24 (88.9)	26 (92.9)	27 (100)	18 (69.2)	21 (84)	24 (92.3)	25 (100)	16 (64)	18 (75)	22 (88)	23 (95.8)
	Bravo					4 (14.3)	3 (11.1)	2 (7.1)		8* (30.8)	4 (16)	2 (7.7)		9* (36)	6* (25)	3 (12)	1 (4.2)
	Charlie																
Marginal discoloration	Alpha	29 (100)	28 (100)	29 (100)	28 (100)	28 (100)	27 (100)	28 (100)	27 (100)	24 (92.3)	24 (96)	25 (96.2)	25 (100)	22 (88)	23 (95.8)	24 (96)	24 (100)
	Bravo									2 (7.7)	1 (4)	1 (3.8)		3 (12)	1 (4.2)	1 (4)	
	Charlie																
Surface texture	Alpha	29 (100)	28 (100)	29 (100)	28 (100)	28 (100)	27 (100)	28 (100)	27 (100)	26 (100)	25 (100)	26 (100)	25 (100)	25 (100)	24 (100)	25 (100)	24 (100)
	Bravo																
	Charlie																
Color match	Alpha	29 (100)	28 (100)	29 (100)	28 (100)	28 (100)	27 (100)	28 (100)	27 (100)	26 (100)	25 (100)	26 (100)	25 (100)	23 (92)	23 (95.8)	25 (100)	24 (100)
	Bravo													2 (8)	1 (4.2)		
	Charlie																
Postoperative sensitivity	Alpha	29 (100)	28 (100)	29 (100)	28 (100)	28 (100)	27 (100)	28 (100)	27 (100)	26 (100)	25 (100)	26 (100)	25 (100)	25 (100)	24 (100)	25 (100)	24 (100)
	Bravo																
	Charlie																
Secondary caries	Alpha	29 (100)	28 (100)	29 (100)	28 (100)	28 (100)	27 (100)	28 (100)	27 (100)	26 (100)	25 (100)	26 (100)	25 (100)	25 (100)	24 (100)	25 (100)	24 (100)
	Bravo																
	Charlie																

*Significant difference in comparison with baseline according to Cochran's Q test followed by McNemar's test ($p<0.05$). CS: Constic; GF: G-ænial Universal Flo; TF-SE: Tetric N-Flow/Tetric N-Bond Universal (self-etch); TF-ER: Tetric N-Flow/Tetric N-Bond Universal (etch&rinse).

trial, and reported that mandibular molars required retreatment more often than did maxillary molars, as they used only cotton rolls for isolation. All restorations in the present study were also placed under cotton-roll isolation. However, no difference in retention between mandibular and maxillary teeth was observed. Given that Wadhwa et al[28] conducted their study on children, patient cooperation may explain the difference in results.

Adhesives are designed to provide long-term bonding, simplified techniques, and a short application time. Universal adhesives are designed to eliminate complications and provide a single product for all situations, with different application options.[26] In the present study, Tetric N-Flow (Ivoclar Vivadent) was applied with an ethanol-based universal adhesive (Tetric N-Bond Universal, Ivoclar Vivadent) in etch-and-rinse and self-etch modes. G-ænial Universal Flo (GC) was applied with an acetone-based universal adhesive (G-Premio Bond, GC) in self-etch mode. The acetone-based and ethanol-based universal adhesive groups exhibited similar clinical outcomes at 24 months. Furthermore, although selective acid etching of enamel prior to the application of the self-etch adhesives has been recommended and pre-etching of dentin is considered to be a clinical risk because it can negatively affect bonding efficacy,[25,26] the results were similar in all of our test groups. The presence of MDP (methacrloxydecyl dihydrogen phosphate) in an adhesive was reported to enhance the tensile dentinal bonding strength relative to that of other self-etch adhesives.[29] G-Premio Bond (GC) showed better marginal adaptation than did Constic (DMG) in this study, although both products contain MDP.

Heavy occlusal forces are not expected to affect small class I restorations, because most functional stresses are absorbed by the remaining tooth structure.[4] Lawson et al[17]

reported that a flowable and a conventional resin composite placed in minimal class I occlusal cavities had similar clinical efficacy and volumetric wear after 2 years of service.

Another self-adhering flowable resin composite (Vertise Flow, Kerr), which contains glycerophosphate dimethacrylate for etching enamel and dentin, exhibited acceptable clinical results as a fissure sealant after 2 years.[15] In another clinical trial, the use of this resin composite for the restoration of minimal occlusal cavities was associated with only the use of a conventional resin composite (Filtek Z250, 3M Oral Care; St Paul, MN, USA) applied with a self-etch adhesive (Clearfil SE Bond, Kuraray Noritake; Tokyo, Japan). Postoperative sensitivity decreased over time in both composite groups.[10] In the present study, no postoperative sensitivity was detected during the follow-up assessments.

The limitations of this clinical trial include the restoration of small cavities and the short evaluation period. However, only limited clinical data on these materials have been available to date. Therefore, studies examining the restoration of deeper and larger occlusal cavities using self-adhering and conventional flowable resin composites with longer follow-ups are needed.

CONCLUSION

In this study, the marginal adaptation of the self-adhering flowable resin composite was inferior to that of other materials at the 2-year follow-up. In addition, the clinical performance of the self-adhering flowable resin composite was similar to that of the highly filled and conventional flowable resin composites in terms of retention, marginal discoloration, surface texture, postoperative sensitivity, and secondary caries.

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Clinical relevance: Self-adhering flowable resin composites can be an alternative to conventional and highly filled flowable resin composites used with universal adhesives to restore occlusal cavities.