ARTICLE IN PRESS
+ MODEL
Journal of Dental Sciences (2014) xx, 1–7

Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.e-jds.com

ELSEVIER

Journal of Dental Sciences

ORIGINAL ARTICLE

Effect of thermal aging on microleakage of current flowable composite resins

Nihan Gönülol [a]*, Ertan Ertaş [a], Aycan Yılmaz [a], Soner Çankaya [b]

[a] *Department of Restorative Dentistry, Faculty of Dentistry, Ondokuz Mayıs University, Samsun, Turkey*
[b] *Department of Biostatistics, Faculty of Medicine, Ordu University, Ordu, Turkey*

Received 12 February 2014; Final revision received 8 March 2014
Available online ■ ■ ■

KEYWORDS
flowable composite resins;
microleakage;
self-adhering;
thermal aging

Abstract *Background/purpose:* To evaluate the microleakage of Class V cavities restored with a new self-adhering resin composite after thermal cycling.
Materials and methods: Standardized box-shaped Class V cavities were prepared on the buccal and lingual sides of 75 intact human molars ($n = 150$). The teeth were randomly divided into five groups of 30 cavities each and restored as follows: GroupVF: Vertise Flow (Kerr Corporation, Orange, CA, USA); Group OVF: OptiBond (Kerr) + Vertise Flow; Group SM: Clearfil SE Bond (Kuraray Medical Inc., Okayama, Japan) + Majesty Flow (Kuraray Medical Inc.); Group TM: Clearfil Tri-S Bond (Kuraray Medical Inc.) + Majesty Flow (Kuraray Medical Inc.); and Group UOA: Uni-etch acid (Bisco Inc., Schaumburg, IL, USA) + One-Step Bond (Bisco Inc.) + Aeliteflo (Bisco Inc.). The restorations were finished with aluminum oxide discs (Sof-Lex, 3M ESPE). The restorations were divided into three subgroups ($n = 10$) and subjected to 1000, 5000, and 15,000 thermal cycles. The teeth were immersed in 0.5% basic fuchsin solution for 24 hours. The dye penetration was examined under a stereomicroscope and scored. The results were statistically analyzed by Kruskal-Wallis, Mann-Whitney U, and Wilcoxon tests.
Results: The Mann-Whitney U test revealed that for cementum leakage scores of 1000 cycled groups, Groups VF, UOA, and OVF showed higher microleakage than Groups TM and SM and the difference was statistically significant ($P < 0.05$). When the composite groups were compared for 5000 and 15,000 thermal cycles, no significant differences were detected for both enamel and cementum microleakage scores ($P > 0.05$).
Conclusion: The sealing ability of the new self-adhering flowable composite is detected as similar to the traditional flowables when subjected to long term thermal aging.

* Corresponding author. Department of Restorative Dentistry, Faculty of Dentistry, Ondokuz Mayıs University, Dentistry, 55139 Samsun, Turkey.
E-mail address: nihan.gonulol@omu.edu.tr (N. Gönülol).

http://dx.doi.org/10.1016/j.jds.2014.03.003

Introduction

Dentin adhesives and resin-based composites have been widely used because of the increasing demand for esthetic restorations in daily clinical dentistry.[1] However, one of the greatest challenges in restorative dentistry is obtaining an effective seal at the tooth/restoration interface.[2] Recently, dentin adhesives have been developed to simplify the three clinical steps: etching, priming, and bonding.[3] All-in-one self-etch adhesives have especially gained great popularity among dentists, due to their simple application which combines these three steps in just one solution.[4] They also reduce the contamination risk and limit over-drying and over-wetting mistakes.[5] However, postoperative sensitivity is decreased due to simultaneous substrate demineralization and resin infiltration.[6,7]

Flowable composites were introduced in the mid-1990s and became widely used for a broad range of restorative applications.[8] They have a filler size similar to hybrid composites, but lower filler content, and therefore reduced viscosities and elastic moduli.[9] Flowable composites have been recommended for use as a lining in Class I and Class II hybrid resin composite restorations and for use as a restorative material in small Class V cavities.[10] Recently, new self-adhering flowable resins have been developed and the first product of this new generation is Vertise Flow (Kerr Corporation, Orange, CA, USA). It has been introduced as a composite resin that includes adhesive resin incorporated into the flowable composite resin, thus eliminating the need for a separate adhesive application.[11] Incorporation of the bonding agent into a flowable composite holds great potential with respect to saving chair time and minimizing handling errors.[12] However, limited information is currently available in the literature for these composites.

Laboratory simulations of clinical service are often performed because clinical trials are costly and time-consuming.[13] Thermocycling has been used in *in vitro* studies to simulate changing intraoral temperature conditions and therefore recreate the aging effects that restorative materials are subjected to in the mouth.[1] The microleakage test is a frequently used laboratory measurement and provides an assessment of the sealing ability of adhesive materials.[14] To our knowledge, although there have been some studies which have investigated the microleakage of new self-adhering composites[11,12,14], there is no study about the effect of long-term thermal aging on the sealing ability of these composites.

The tested null hypotheses of this study were: (1) self-adhering composites exhibit similar microleakage as compared with conventional flowable composites; and (2) long-term thermocycling procedures would not compromise the sealing abilities of the tested composites.

Table 1 Manufacturers and compositions of the materials used in this study.

Material	LOT no/shade	Composition	Manufacturer
Vertise Flow	2894473/A2	GPDM, HEMA, methacrylate co-monomers, prepolymerized filler, barium glass, nanosized colloidal silica, nanosized ytterbium fluoride 70% (w) filler load	Kerr Corporation, Orange, CA, USA
Clearfil Majesty Flow	00320A/A2	Silanated barium glass filler, silanated colloidal silica, TEGDMA, hydrophobic aromatic dimethacrylate, di-camphorquinone, 81% (w) filler load	Kuraray Medical Inc., Okayama, Japan
Aeliteflo	1000006650/A2	Ethoxylated bis-GMA, barium glass filler, triethyleneglycol dimethacrylate, 72 % (w) filler load	Bisco Inc., Schaumburg, IL, USA
OptiBond All-In-One	454550	GPDM, co-monomers including mono- and di-functional methacrylate monomers, water, acetone, and ethanol, camphorquinone-based photoinitiator system, three nanosized fillers, sodium hexafluorosilicate and ytterbium fluoride	Kerr Corporation, Orange, CA, USA
Clearfil SE Bond	041819	*Primer:* MDP, HEMA, hydrophilic aliphatic dimethacrylate, di-camphorquinone, N,N-diethanol p-toluidine, water *Bond:* MDP, bis-GMA, HEMA, hydrophobic aliphatic dimethacrylate, di-camphorquinone, N,N-diethanol p-toluidine, colloidal silica	Kuraray Medical Inc., Okayama, Japan
Clearfil Tri-S Bond	041209	MDP, bis-GMA, HEMA, hydrophobic dimethacrylate, di-camphorquinone, ethyl alcohol, water, colloidal silica	Kuraray Medical Inc., Okayama, Japan
One-Step Bond	1100012254	Biphenyl dimethacrylate, hydroxyethyl methacrylate, acetone	Bisco Inc, Schaumburg, IL, USA
Uni-etch acid	1100012116	Phosphoric acid (32%), benzalkonium chloride	Bisco Inc, Schaumburg, IL, USA

GPDM = glycerophosphate dimethacrylate; HEMA = Hydoxyethylmethacrylate; TEGDMA = triethyleneglycol-dimethacrylate; Bis-GMA = Bisphenol A Glycidyl Methacrylate; MDP = 10-methacryloyloxi decyl-dihydrogen phosphate.

Please cite this article in press as: Gönülol N, et al., Effect of thermal aging on microleakage of current flowable composite resins, Journal of Dental Sciences (2014), http://dx.doi.org/10.1016/j.jds.2014.03.003