Does the Wear Resistance of Packable Composite Equal that of Dental Amalgam?

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ABSTRACT

Background: There is little evidence that packable composites are sufficiently wear resistant to be used as an alternative to amalgam.

Purpose: The purpose of this study was to evaluate wear rates of packable composites compared with hybrid resin composites and amalgams by an in vitro wear test.

Materials and Methods: The following composites were used: three packable composites (SureFil, Dentsply/Caulk, Milford, DE, USA; Alert, Pentron Clinical Technologies, Wallingford, CT, USA; and Solitaire, Heraeus Kulzer, Wehrheim, Germany), two hybrid resin composites (TPH Spectrum, Dentsply/Caulk; and Pyramid enamel, Bisco Inc., Schaumburg, IL, USA), and two amalgams (Tytin, Kerr Manufacturing Co., Romulus, MI, USA; and Dispersalloy, Dentsply/Caulk). Cylindrical Class I cavities prepared on occlusally flattened, extracted human molars were restored with respective materials according to the manufacturers' instructions. Generalized, localized, and antagonistic enamel wear tests were carried out by a University of Alabama at Birmingham (UAB) wear simulator according to previously reported methods. Seven specimens were tested for each group, and the wear depths were measured on profilometric tracings. The data for each wear mode were independently analyzed by one-way analysis of variance and Fisher's exact test ($p \leq .05$).

Results: The generalized wear values for SureFil (7.0 ± 3.5 μm), Alert (8.6 ± 1.8 μm), and Pyramid (3.9 ± 0.5 μm) were not statistically different from those of amalgam materials (Tytin 5.8 ± 0.7 μm, Dispersalloy 6.0 ± 0.9 μm) but were different from those of Solitaire (23.9 ± 2.6 μm) and TPH (30.6 ± 5.5 μm). The localized wear values for SureFil (19.8 ± 14.2 μm) and Alert (28.0 ± 1.6 μm) were significantly smaller than for all other materials. For antagonistic enamel wear, Solitaire exhibited a minimal value (3.4 ± 0.9 μm), whereas values of SureFil (12.6 ± 5.6 μm) and Alert (12.0 ± 6.6 μm) were not statistically different from those of TPH (11.0 ± 4.0 μm) and amalgams (Tytin 14.5 ± 4.3 μm, Dispersalloy 7.8 ± 3.3 μm).

Conclusions: It can be concluded that SureFil and Alert packable composites possess similar wear resistance and abrasiveness to amalgam on the basis of the limitations of this study, which simulated 3 years of clinical wear.

CLINICAL SIGNIFICANCE

Based upon this in vitro study, it would seem that the packable composites tested can be used as an alternative to amalgam for posterior occlusal restorations.

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Amalgam has been the first choice for direct restorations, particularly large occlusal restorations, for the posterior regions, although it is not a satisfactory material from an esthetic point of

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view. Amalgam substitutes have been explored because of several problems including mercury toxicity and environmental pollution by mercury waste.[1] Posterior resin composite has been used and investigated as one of the most promising substitutes as a direct restorative system.[2] A decade ago, the mechanical properties of composites were inferior to those of amalgam, and their longevity was shorter in general practice.[3,4] Early posterior composite restorations required replacement with indirect restorations including full crowns owing to marginal deterioration and secondary caries.[5–7] This failure has been lessened by the development of enamel/dentin bonding systems, but attrition wear is still a problem when composites are placed in heavy occlusal contact.[8] Various types of posterior resin composites have been developed and are commercially available,[9] and improved clinical performances including wear resistance have been reported by several studies.[10–14] Packable resin composite—highly filled, posterior resin composite—is marketed as a substitute for amalgam because its manipulation is similar compared with that of amalgam restoration.[9,15]

Wear resistance is one of the most important factors affecting the longevity of direct resin composite materials used for posterior restorations. Although it is important to determine the longevity, including wear resistance of this type of novel material, clinicians often have to wait for several years until ongoing clinical studies are completed. There are some investigations that attest to the fact that laboratory wear simulations are of great value in screening new materials and are relatively predictive of clinical performance.[16–27] The American Dental Association (ADA) has developed a guideline for acceptable wear rates for posterior resin composites.[28] According to the current ADA criterion, the wear rate of posterior resin composites should be < 50 μm by means of a specific simulated 3-year wear test.

The hypothesis of this study was that as filler loading in resin composites increased, less wear rate would be expected but more prominent antagonistic enamel wear would be anticipated. Therefore, the purpose of this study was twofold: to evaluate simulated wear rates of packable resin composite materials compared with hybrid resin composites and amalgam materials by an in vitro wear-simulation system, and to indicate whether the wear rates of packable resin composites are acceptable to ADA criterion for posterior composites.

MATERIALS AND METHODS

Product names, manufacturers, types and sizes of filler particles, total filler loading, and bonding agents used for sample preparation of resin composites in this study are presented in Table 1. Composites used include three packable resin composites, two hybrid resin composites, and two amalgam materials. For the packable composites, SureFil (Dentsply/Caulk, Milford, DE, USA), Alert (Pentron Clinical Technologies, Wallingford, CT, USA), and Solitaire (Heraeus Kulzer, Wehrheim, Germany) were used since they are typically available materials in the United States. TPH Spectrum composite (Dentsply/Caulk) and Pyramid enamel (Bisco Inc., Schaumburg, IL, USA) were the hybrid resin composites used as they are applicable for posterior restorations. Companion bonding systems for the respective materials are as follows: Prime&Bond NT (Dentsply/Caulk) for SureFil and TPH, Bond-One (Pentron Clinical Technologies) for Alert, One-Step (Bisco Inc.) for Pyramid, and Solid Bond (Heraeus Kulzer) for Solitaire. The amalgam materials used were high-copper alloys Tytin (Kerr Manufacturing Co., Romulus, MI, USA), used as a spherical alloy, and Dispersalloy (Dentsply/Caulk), used as an admixed alloy.

A series of in vitro wear tests, including generalized, localized, and antagonistic enamel tests, were carried out with a UAB wear simulator.[17]

Specimen Preparation

Sound, caries-free, extracted human molars were selected and stored in a 2% solution of sodium azide. The root tips on each specimen were

TABLE 1. MATERIALS: PRODUCT NAME, MANUFACTURER, DETAILS OF FILLER, AND BONDING AGENT.

Product (Lot No.)	Manufacturer	Filler* Type	Filler* Size (μm)	Total Filler Loading*	Bonding Agent (Lot No.)
SureFil	Dentsply/Caulk	Ba-B-F silicate	0.8	77 wt%	Prime&Bond NT
(001027)		Fumed silica	0.04	66 vol%	(9809000658)
Alert	Pentron Clinical	Ba-B-Al silicate	0.7	84 wt%	Bond-One
(870912)	Technologies	Glass fiber	10 diameter, 40 long	70 vol%	(29551)
		Fumed silica	0.04		
Pyramid Enamel	Bisco Inc.	Ba silicate	2.0	78 wt%	One-Step
(109138)		Fumed silica	0.01	53 vol%	(069206)
Solitaire	Heraeus Kulzer	Porous glass	13.5	76 wt%	Solid Bond
(86826)		Ba-Al-F silicate	2.0	66 vol%	(086809)
TPH Spectrum	Dentsply/Caulk	Ba silicate	0.8	77 wt%	Prime&Bond NT
(021204)				66 vol%	(000622)

*Collected from respective manufacturers' home pages and personal communications with technical service departments.

reduced and then mounted in a brass specimen holder using a self-cured acrylic resin. The occlusal surface was ground flat using a series of silicon carbide metallographic papers down to 600 grit. The ground surface consisted entirely of enamel that was at least 1.0 mm thick.

Next, a well-defined, cylindrical-shaped cavity preparation was generated on the occlusal surface of the mounted specimen. The dimensions of the cavity preparation were 4.0 mm in diameter and 3.0 mm deep. All of the cavosurface margins were carefully finished with a sharp carbide bur. They were immediately restored with composites in conjunction with the respective bonding systems according to the manufacturers' instructions (Table 2). All cavities for composite restorations other than SureFil were restored in three increments. The first and second increments were polymerized for 20 seconds

TABLE 2. RESTORATIVE PROCEDURES FOR EACH SYSTEM.

System	Cavity Conditioning	Bonding	Light Curing (s)	Filling	Light Curing
SureFil	34% phosphoric acid 20 s + rinse	Prime&Bond NT 20 s	10	Bulk	40 s
Alert	37% phosphoric acid 20 s + rinse	Bond-One 10 s	10	3 increments	First 2 increments 20 s; final increment 40 s
Pyramid Enamel	10% phosphoric acid 15 s + rinse	One-Step 10 s	10	3 increments	First 2 increments 20 s; final increment 40 s
Solitaire	20% phosphoric acid 30 s + rinse	Solid Bond Primer 30 s + Solid Bond Sealer	40	3 increments	First 2 increments 20 s; final increment 40 s
TPH Spectrum	34% phosphoric acid 20 s + rinse	Prime&Bond NT 20 s	10	3 increments	First 2 increments 20 s; final increment 40 s

each, and the final increment was polymerized for 40 seconds using a visible light–curing unit (MAX, Dentsply/Caulk.). The 9 mm diameter tip was positioned 5 mm from the specimen. The energy density of the curing unit was 420 mW/cm^2, and the light intensity was confirmed every 20 specimens using a visible light–curing meter (Cure Rite, Dentsply/Caulk). For specimens restored with SureFil, the cavities were bulk filled and polymerized for 40 seconds. All of the final restorations were slightly overfilled from the baseline to avoid the formation of an air-inhibited unpolymerized layer at the baseline.

Using a custom-made, hand-held device, the surface of the restoration was finished immediately after polymerization with a 400-grit silicon carbide paper in the presence of water. This procedure ensured that the flat occlusal surface was parallel to a horizontal plane and to the flat surface of the energy-generating stylus. The surface was polished with a 600-grit silicon carbide paper directly prior to the wear test.

Amalgam restorations were completed according to the manufacturers' instructions. Amalgam specimens were stored in 37°C water for 24 hours to secure the set of amalgam; then the restored surface was finished with a 600-grit silicon carbide paper with copious irrigation. Each mounted specimen was inserted into the wear-testing apparatus and surrounded by a tightly fitting cylinder that was filled with polymethylmethacrylate (PMMA)-water slurry. This assembly, along with a bank of three other specimens, was submerged into a water bath filled with room-temperature tap water.

Wear Tests

Different types of styli were used for the respective tests (Figure 1). The generalized wear testing simulated the wear provoked by a food bolus during the masticatory process.[21,24] In this testing, a flat, polyacetal stylus was used in the presence of an artificial food bolus. The food bolus consisted of a mixture of equal weights of nonplasticized PMMA powers (HG-5, Dentsply/Caulk) and tap water. The flat stylus, whose diameter was 8.0 mm, was appropriately centered so that it completely covered the entire restoration as well as 2 mm of the adjacent enamel surface. The stylus was vertically loaded onto the restored surface and rotated 15°; after counter-rotating, it was moved upward vertically to its original position. The stylus was resurfaced with a 600-grit silicon carbide paper at the beginning of every specimen test.

The localized wear test simulated the occlusal contact wear created by antagonistic cusps.[19,20] Rather than employing a flat stylus for imparting a load to the occlusal surface, this aspect of the study involved the use of a cusp-simulated metal stylus that had a stainless steel ball on the tip with a diameter of 0.32 cm. Again, the PMMA-water slurry simulated an artificial food bolus.

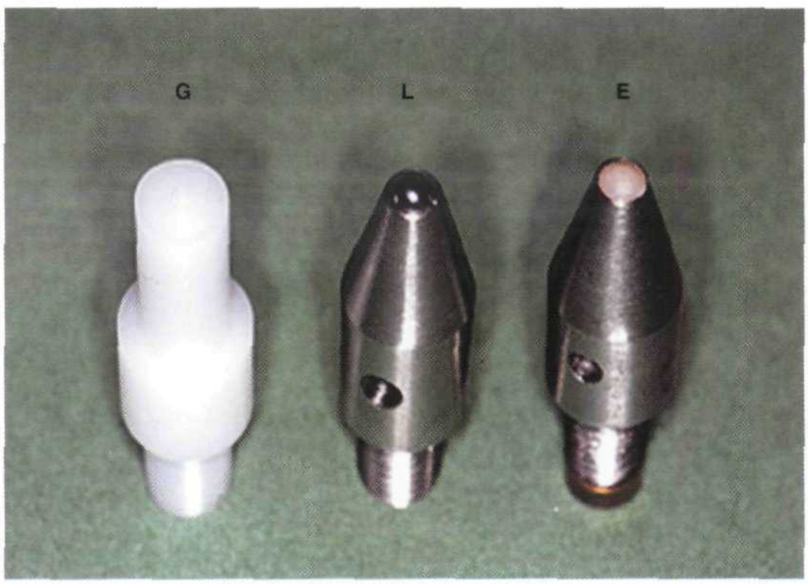

Figure 1. Styli for respective wear tests. G = generalized wear stylus made of polyacetal; L = localized wear stylus with stainless steel ball tip; E = enamel wear stylus with composite tip.

The antagonistic enamel wear test was designed to evaluate the abrasiveness (ie, the unfavorable potential of an abrading antagonist) of restorative materials to the opposing enamel dentition.[22] The hemispherical-shaped, metal stylus tips were replaced with the respective restorative materials, according to a technique my colleagues and I have reported previously.[22] A polyethylene transparent index was fabricated from a standard metal tip using a vacuum former (Vac-Former, Great Lakes Orthodontics, Tonawanda, NY, USA). Each resin composite was placed into both the plastic index and the orifice of the empty metal stylus. Each index was then placed back into the original position on the stylus and light cured for 60 seconds using a visible light–curing unit (MAX). Amalgam tips were molded using the index. The antagonistic enamel specimens were prepared by grinding proximal surfaces of the molars. The enamel surface was finished with a 600-grit silicon carbide paper and polished with 3 μm alumina slurry with copious irrigation. The composite specimens were placed perpendicular to the enamel surfaces. PMMA-water slurry was not used for this test, which involved the direct contact of the materials on enamel.

A load of 75 N was applied vertically onto the specimen surfaces at 1.2 Hz for all of the testings. For the generalized wear test, 400,000 wear cycles were employed, and for the localized wear and antagonistic enamel wear tests, 100,000 cycles were used. The loading level and cycles were selected according to previous studies.[19–22,24] Seven specimens were tested for each group.

The wear depth for each condition was measured on the profilometric tracings. Respective worn areas were scanned with a profilometer (Surfanalyzer 4000, Federal Products, Providence, RI, USA) using a high-resolution, diamond stylus (EPT-01049, 2.54 μm radius) with an accuracy of 1 μm. For the specimens used in the generalized wear test, the surfaces were subsequently scanned at every 45° so that eight readings adjacent to the cavosurface margin of the restorations were obtained for each specimen. For the specimens of both localized and enamel wear tests, worn areas were scanned at 90° angles. The tracings crossed the worn area through two planes of the surface, and the deepest area of the wear facet was determined after multiple scans and was measured in micrometers.

Typical profilometric tracings after respective wear tests are presented in Figure 2. The readings were averaged for each specimen, and the wear depths were determined by averaging the values of seven specimens. The data for each wear-test mode were independently analyzed by one-way analysis of variance, and multiple comparisons among respective materials were determined by Fisher's exact test at a 95% level of confidence.

Scanning Electron Microscope Evaluation

After completion of respective wear tests, replicas of all specimen surfaces were made to follow a clinical-evaluation technique. Replicas were completed using a polyvinylsiloxane impression material (Reprosil, Dentsply/Caulk, Milford, DE, USA) and an epoxy resin (Epoxy-die, Ivoclar Vivadent, Amherst, NY, USA). After being sputter coated with gold platinum (Hummer Sputter Coaters, Anatech, Alexandria, KY, USA), their surfaces were observed to visualize surface wear with a scanning electron microscope (ISI-100B, International Scientific Instruments AKA/HI, Tokyo, Japan).

RESULTS

The mean values and SDs of wear depths in the respective wear tests

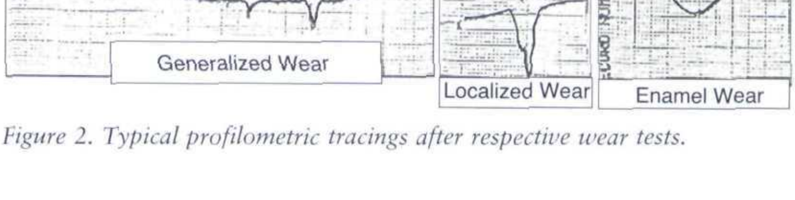

Figure 2. Typical profilometric tracings after respective wear tests.

are presented in Figure 3. The results of the generalized wear test demonstrated that the wear rates for SureFil (7.0 ± 3.5 μm), Alert (8.6 ± 1.8 μm), and Pyramid (3.9 ± 0.5 μm) were not statistically different from those of amalgam materials (Tytin 5.8 ± 0.7 μm, Dispersalloy 6.0 ± 0.9 μm) but were significantly different from those of Solitaire (23.9 ± 2.6 μm) and TPH (30.6 ± 5.5 μm).

The results of the localized wear test demonstrated that SureFil (19.8 ± 14.2 μm) and Alert (28.0 ± 1.6 μm) were significantly different from all the other materials. The values of Pyramid (45.5 ± 13.0 μm) and Solitaire (73.5 ± 6.8 μm) were not statistically different from those of TPH (64.0 ± 12.5 μm) and amalgam materials (Tytin 76.4 ± 17.6 μm, Dispersalloy 71.0 ± 8.9 μm). Thus, Pyramid was very wear resistant in the generalized wear test but not for the localized wear test.

The results of tests for antagonistic enamel wear demonstrated that Solitaire exhibited minimal abrasiveness (3.4 ± 0.9 μm) toward enamel, although the wear of this material was greater in the other wear modes. The enamel wear values of SureFil (12.6 ± 5.6 μm) and Alert (12.0 ± 6.6 μm) were not statistically different from those of TPH (11.0 ± 4.0 μm) and amalgam materials (Tytin 14.5 ± 4.3 μm, Dispersalloy 7.8 ± 3.3 μm).

A series of typical scanning electron micrographs of tested materials after respective wear tests is shown in Figures 4 to 7. For the amalgam specimens, only Dispersalloy was presented, as Tytin surfaces showed no significant differences with those of Dispersalloy. The image in Figure 4 represents the worn surfaces after the generalized wear test. The worn surfaces of SureFil, TPH, and amalgam were quite smooth, whereas the surfaces of Alert, Solitaire, and Pyramid were slightly coarse.

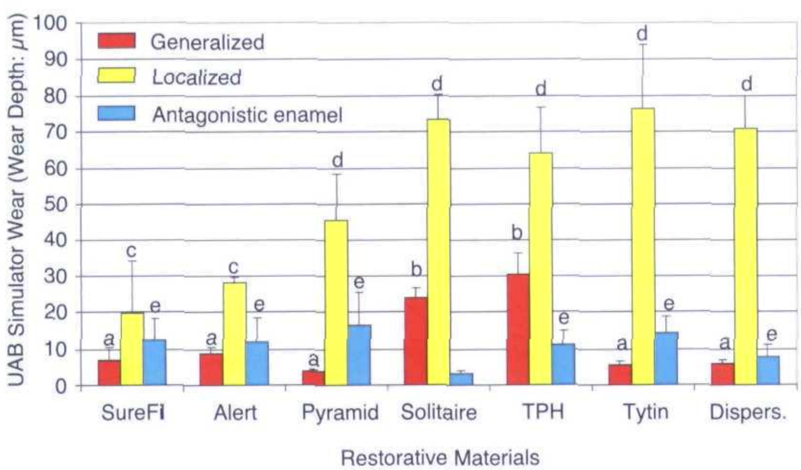

Figure 3. Results of the in vitro wear tests in a UAB wear simulator. Respective wear tests were completed with different types of styli. Error bars represent SDs. Bars with the same letters are not *significantly different within the same wear mode ($p \leq .05$).*

Figure 5 shows the composite specimens after the localized wear test. The worn surface of TPH (see Figure 5E) was the smoothest among all materials. The surfaces of SureFil, Solitaire, Pyramid, and the amalgam were slightly coarser than that of TPH. Although the outline of the filler particles can be detected, no debonding was observed at the filler-matrix interface on the Alert specimen (see Figure 5B).

Figure 6 demonstrates the enamel specimens worn against the resin composites and amalgam materials. Enamel surfaces against the packable composites exhibited a very smooth texture and were similar to those against the hybrid resin composites. Some flaws were seen on the enamel surfaces opposing the amalgam (see Figure 6F).

Figure 7 shows the surfaces of worn stylus tips made of various materials against the flat enamel surfaces. SureFil, Solitaire, Pyramid, and TPH showed quite smooth surfaces, whereas the Alert specimen exhibited some exfoliation of the cylindrical filler particles (see Figure 7B). Amalgam specimens

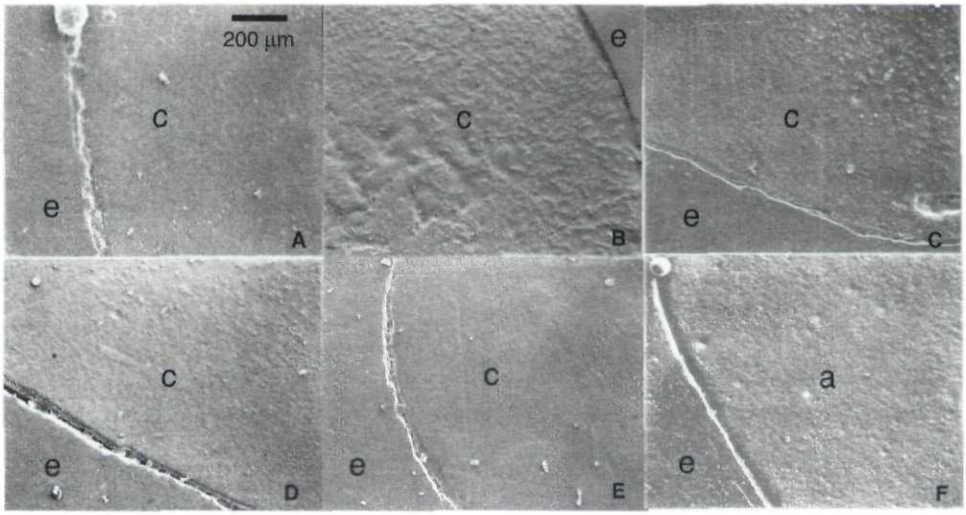

Figure 4. Scanning electron micrographs of worn surfaces after the generalized wear test (×100 original magnification): A, SureFil; B, *Alert;* C, *Solitaire;* D, *Pyramid;* E, *TPH;* F, *Dispersalloy. Note that individual filler particles can be seen on Alert, Solitaire, and Pyramid specimens. a = amalgam; c = composite; e = enamel.*

left some flaws on the surfaces (see Figure 7F).

DISCUSSION

The main purpose of this study was to evaluate the wear rates of a series of packable composites and compare them with those of hybrid resin composites and amalgam materials. The generalized wear represents that caused by repetitive contact with a food bolus after a long period of mastication. According to the literature, wear values after 400,000 cycles by the generalized wear test correlate well with 3-year clinical wear values.[24] Based upon the results of the generalized wear test, SureFil, Alert, and Pyramid seem to have wear resistance

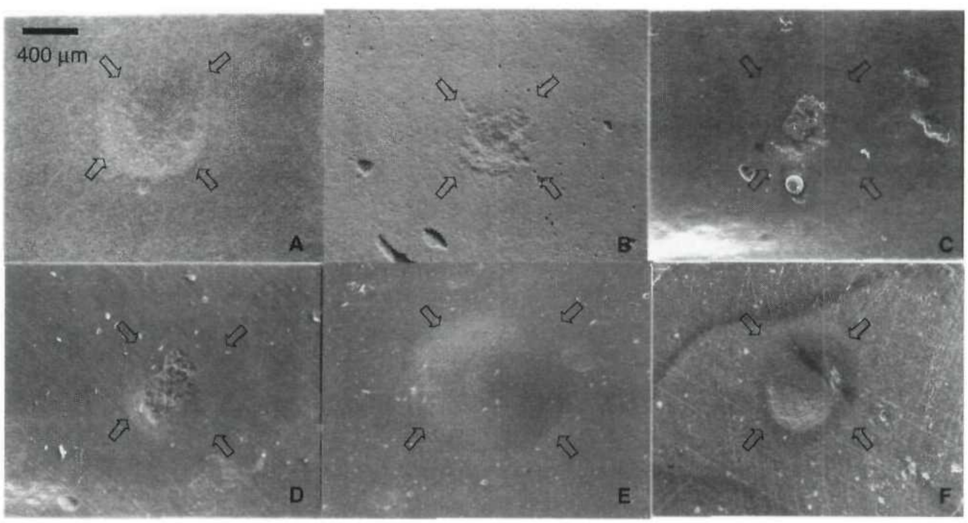

Figure 5. Scanning electron micrographs of the specimens after the localized wear test (×50 original magnification): A, *SureFil;* B, *Alert;* C, *Solitaire;* D, *Pyramid;* E, *TPH;* F, *Dispersalloy.* Arrows *indicate borders of wear. Note that cylindrical filler particles can be seen on Alert specimens. Clusters of wear debris remained on Solitaire and Pyramid after the wear process.*

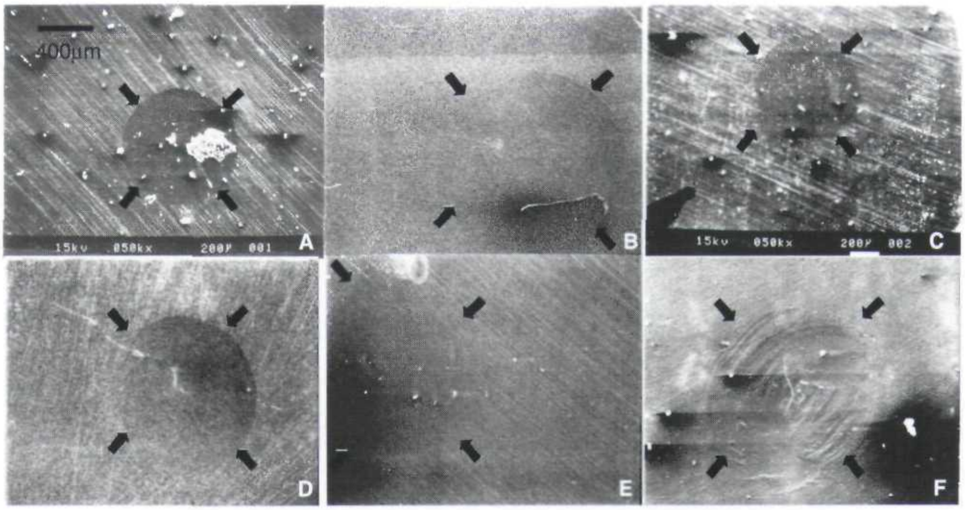

Figure 6. Scanning electron micrographs of enamel specimens worn against respective materials (×50 original magnification): A, *SureFil;* B, *Alert;* C, *Solitaire;* D, *Pyramid;* E, *TPH;* F, *Dispersalloy.* Arrows *indicate borders of wear. Note that the surfaces against composites were quite smooth, whereas amalgam left some flaws.*

equivalent to that of amalgam. However, it should be noted that this presumption is based on a relatively short-term (3 yr) clinical simulation, and the results do not ensure that in vivo or longer-term wear performance will remain the same compared with amalgam.

SureFil was the only material that was bulk filled and photopolymerized. This regimen was employed to strictly follow the manufacturer's recommendation. As the degree of polymerization relates directly to the energy density of incident light, this regimen seems to affect the wear resistance. However,

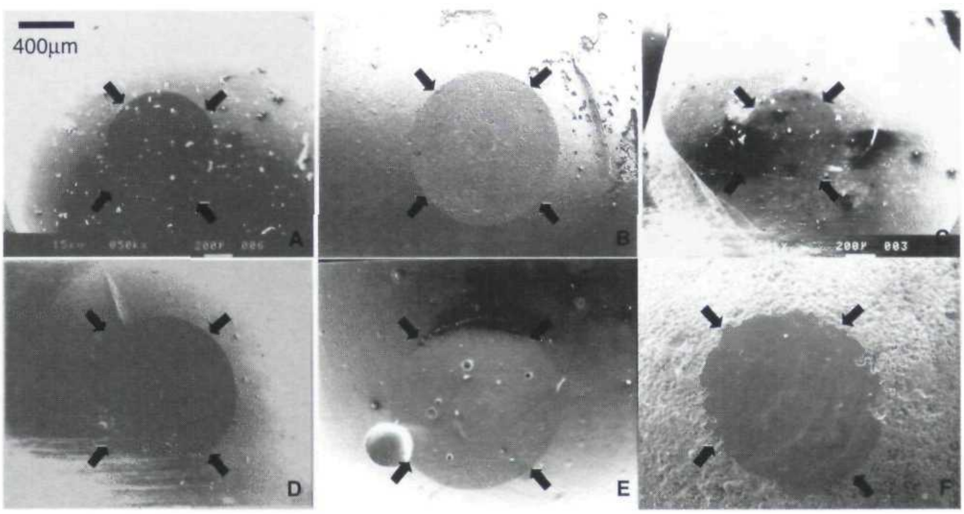

Figure 7. Scanning electron micrographs of material surfaces worn against the flat enamel surfaces (×50 original magnification): A, *SureFil;* B, *Alert;* C, *Solitaire;* D, *Pyramid;* E, *TPH;* F, *Dispersalloy.* Arrows *indicate borders of wear. Note that Alert specimen exhibited some filler exfoliation. Other composite specimens showed smooth surfaces, whereas amalgam left some flaws.*

the wear value of SureFil was not significantly different from those of the other packable composites. This lack of significance may be due to the small-sized cavity preparation.

A separately published clinical report observed the generalized wear value of SureFil after 1 year to be 2.5 to 27.5 μm.[29] The generalized wear after 400,000 cycles (7.0 μm) is equivalent to that after a 3-year clinical period. Thus, based upon the results of this study, the annual wear value for SureFil is approximately 2.3 μm, which coincides well with the minimum value of in vivo clinical data. The simulated 3-year wear rates of packable composites evaluated in this study ranged from 7.0 to 23.9 μm. Therefore, it appears that the packable composites used in this study fulfill the ADA criterion for wear.[28] The worn surfaces of the packable composites after the generalized wear test exhibited quite a smooth appearance, similar to that of the amalgam surfaces; these materials can therefore be thought of as quite wear resistant. The incorporation of fumed silica may be attributed to small wear values and the smooth worn surface as the wear of resin matrix can be protected due to minimum interparticle space (protection hypothesis).[30]

The localized wear represents that created by repetitive, localized stressing against an antagonistic cusp. To minimize counter wear, a hardened stainless steel stylus was used as a simulated antagonistic cusp. Although the surface smoothness seemed to be different from human enamel, the highly smooth surface along with the use of PMMA slurry prevented counter wear. For the localized and antagonistic enamel wear tests, 100,000 cycles was selected. Unlike the cycle number in the generalized wear test, 100,000 cycles has not been correlated to any particular clinical longevity parameter. For the localized wear, SureFil and Alert demonstrated greater wear resistance than did amalgam, whereas Pyramid and Solitaire had wear resistances similar to amalgam. Although the mechanical strengths and wear of some packable composites were not significantly different from those of conventional posterior composites,[31,32] wear resistance of SureFil and Alert obtained in this study showed a significant difference. The hypothesis that higher wear resistance would be obtained when the filler loading increased was not fully accepted. After the localized wear test, the specimens exhibited a rough texture when excessive surface deterioration, such as filler debonding and exfoliation, occurred. This observation is quite common whenever the filler-matrix bonding is inefficient. However, none of the materials tested exhibited a very coarse, worn surface after the test. These results are probably attributable to improvements in the filler-matrix bonding.

The increased wear resistance of composite materials could be a result of an increased abrasiveness to opposing dentition. Therefore, it is important to evaluate the enamel wear created by the direct contact of the restoratives to determine the extent of their abrasiveness.[22,33–35] The hypothesis of this study that as filler loading increased, more prominent antagonistic enamel would be anticipated was rejected as most of the packable composite specimens exhibited abrasiveness similar to that of the hybrid composite control. This contradictory result may be due to the improvement in filler-loading technology as well as filler-matrix bonding.[10,36] Solitaire, which exhibited the greatest amount of wear of the packable composites in both generalized and localized testings, demonstrated minimal abrasiveness. This may relate to the effect of porous filler incorporation. One of the important factors affecting the wear resistance and abrasiveness of the resin composite material is filler content. Filler loading of the TPH composite and Solitaire is almost the same, whereas most of the packable composites have similar filler loading. Higher filler-loading material is thought to lead to greater wear resistance in localized wear, but this is not the case when the filler-matrix bond is not appropriately controlled. Filler particle size and surface smoothness are important factors in generalized wear. The size and shape of a filler may also have an effect on wear characteristics.[37] Various sizes and shapes of fillers are used for these materials. Because a direct correlation between these factors and wear was not clarified in this study, *further investigations are needed* to better understand this relationship and thereby to find the most appropriate materials for posterior resin composite restorations.

The most important factor in considering the wear characteristics of composite is the balancing of wear resistance and abrasiveness. The ideal material possesses both a high wear resistance and a minimum abrasiveness. For example, SureFil and Alert demonstrated similar abrasiveness compared with amalgam, and the worn enamel against these materials was smoother compared with that against amalgam. Based upon the results of this in vitro study, it appears that SureFil and Alert seem to attain this balance of good wear resistance and low abrasiveness toward enamel when compared with amalgam. However, this presumption is only based on a short-term, clinical simulation and does not ensure longer-term wear performance; therefore, further investigations are desired to evaluate the longevity of resin composite materials.

CONCLUSIONS

Within the limitations of the simulation and for the range of representative materials tested, it appears that the packable composites used in this study fulfill the ADA criterion for wear. SureFil and Alert packable composites possess similar wear resistance and abrasiveness to amalgam; they exhibited no statistical *differences with amalgam in the* generalized wear (simulated 3-year wear) and the antagonistic enamel wear rates, and less localized wear than did the other materials tested ($p \leq .05$). Further long-term clinical studies should be performed to confirm these laboratory results.

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COMMENTARY

DOES THE WEAR RESISTANCE OF PACKABLE COMPOSITE EQUAL THAT OF DENTAL AMALGAM?

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Clinically, the questions in most peoples' mind regarding the value of packable or other posterior composite restorations versus dental amalgams involve (1) secondary caries resistance, (2) wear resistance, (3) resistance to intraoral degradation, and (4) bulk fracture resistance. Everything else is probably trivial if posterior composite restorations are well placed. Frequently, the concern for postoperative sensitivity is mentioned, but the actual incidence appears to be very low for well-placed restorations that do not involve a deep proximal box in the preparation design.

Resistance to dental caries depends almost exclusively on the success of the bonding system used with the composite and not on the composite per se. One must be cautious when interpreting clinical research results. Dental caries associated with tooth-colored materials has been reported to occur 94% of the time in clinical practice when associated with proximal margins.[1]

Wear resistance is a fickle property. It depends on several factors: (1) type of loading events, (2) width of restoration, and (3) intraoral location. Only some of these are measured in laboratory simulations or clinical research trial designs. There are probably five distinct types of loading events: contact-free or food bolus wear, occlusal contact area wear,

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