New Flowable Resins: Good, Bad, or just Hype?

Gordon’s Clinical Bottom Line: Flowable resin-based composite materials have become popular beyond the expectations of most researchers. It appears that the flow characteristic is the major reason for the popularity. Some of the physical characteristics of previously marketed flowable composites could have been better. Are the new ones improved? How do they compare with conventional restorative resins? CR scientists and clinicians answer these questions in this report.

• Many conventional composites have been proven clinically.
• Flowables have generally been inferior in key areas of wear, shrinkage, and strength, but main reasons for usage among clinicians include flow, ease of handling, and better margin adaptation.
• The number of manufacturer-indicated uses for flowables has gradually increased in recent years, evolving from simply a liner/base beneath a conventional composite, to also include some/all Class I–VI.
• Although further research is needed, in-vitro experiments and short-term clinical trials have given an early indication of some progress for flowable composites.

This report provides direction to clinicians concerning limitations and recommended uses for flowable composites currently available, a comparison of key characteristics between representative products, clinical tips for composite placement, and CR conclusions on flowable vs. conventional composite at present.

Comparison Chart

Listed below are multiple representative flowable and conventional composites currently available; information shown is based on both in-vitro scientific testing and clinical feedback. Some manufacturer claims appear to be ambitious for flowable composites. Physical properties and clinical observation demand further research on these claims.

CR Survey on Flowables: Summary of Results (N = 1579)
• 94% use flowable composites
• 56% say flowable composites make up less than 10% of their total composite use
• Where used: 75% Internal liner/base, 33% Class V, 31% Internal “bulk filler,” 27% Class I, 60% Class III, 4% Class VI, 3% Class II, 3% Class IV
• Popular brands: 35% Filtek Supreme Ultra Flowable (3M ESPE), 24% SureFil SDR flow (Dentsply Caulk), 15% Flow-It ALC (Pentron), 13% Tetric EvoFlow (Ivoclar Vivadent)
• Problems observed with flowables: 47% high wear, 45% low strength, 29% high shrinkage, 24% difficult clinical placement due to excessively low viscosity
• CR interpretation of survey: Flowable composites are currently very popular. About one third of clinicians are moving beyond internal liner/base usage to also use flowables as an internal bulk filler and/or for Class I and V restorations; very few are using flowables for occlusal applications.

Select Manufacturer-Suggested Applications
• Use indicated in instructions, further research needed

Select Manufacturer-Suggested Applications
• CR clinically proven uses

Applications shown comprise only the most ambitious claims in product instructions. **

Summary of Chart
Overlap between the flowable and conventional composites evaluated, in nearly every category of relevant material properties, conveys progress by manufacturers in general. However, one property of flowable composites which lacks long-term clinical data is occlusal wear resistance. Some manufacturer claims for flowable composites are ambitious.
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Comparison Chart (Continued)

* Flow is an important factor of handling, but is highly dependent on desired use.
† Flowable wear data was compiled from multiple sources in literature; wear ratings for conventional composite controls are based on CR long-term clinical data.
‡ High polymerization stress can cause cracking in tooth structure upon light cure, due to resin shrinkage. Stress values for flowable composites have improved from previous versions.
§ Although all products listed meet the ISO 4049 criterion of flexural strength for occlusal use (≥80 MPa), other criteria are necessary for clinical success.

** Moderate-intensity halogen curing light with manufacturer-recommended cure times; LED fast light for 3 seconds (VALO by Ultradent). Measurements taken at immediate conclusion of light cure. A2 shade used for depth of cure testing.
†† Plus an additional 90¢ per tip used for wasted material from dual-cartridge mixing. Necessary reusable dispensing gun is $125.
§§ HyperFil (dual-cure) auto-polymerizes to any depth within 2–4 minutes.
*** Marked boxes may have exceptions based on clinical case; see product instructions.

Clinical Tips

• Use flowables conservatively. Most common use is as a base or liner beneath conventional composite; however, resin-modified glass ionomer (RMGI) liner (examples: 3M Vitrebond, GC Fuji Lining LC) is preferred by many clinicians because of its numerous advantages, including extended fluoride release and no need for bonding agent before placement.

• Additional uses for flowables include: easy adaptation into intricate irregularities or retentive features, and to potentially provide some flexibility in the restoration.

• Do not use flowables in high-stress areas. Although some manufacturers currently promote use of their flowable product for occlusal locations, past research shows flowables in general to be unacceptable for this clinical situation and further research is needed.

• Low polymerization stress continues to be the most important performance criterion of flowable composites, with acceptable radiopacity, low occurrence of voids, and low flexural modulus (for non-occlusal surfaces) also being of interest.

• Use an explorer to help composite flow into tight crevices. Wetting every surface in a deep or hard-to-reach cavity can decrease the risk of subsequent caries.

• Flowables, used after placement of an appropriate bonding agent, can help decrease tooth sensitivity when used as a liner; RMGI liner can have a similar effect.

• To increase flow of conventional composites, heat prior to placement by either: 1) allowing thin layer to sit on tooth structure for a few seconds to absorb body heat, or 2) heating in a compule heater unit (example: CalSet by AdDent Inc.), before shaping of the composite.

• Incremental filling is still recommended for preps deeper than 2 mm, since bulk filling can cause issues in many instances and most lights are incapable of adequately curing deep areas. See Clinicians Report January 2012 for more information on this topic.

• Flowable composites generally have fewer voids than conventional composites.

CR Conclusions: • Clinicians should use flowable composites conservatively (e.g., liner/base, non-stress locations), pending additional research.
• Although manufacturers may advertise more demanding indications, newer flowables (including those with higher filler content) do not presently appear to provide a significant improvement over the previous flowable generation.
• The key property of wear (necessary for occlusal indications) continues to be a weakness of some flowable composites, despite their generally acceptable shrinkage and flexural properties (see chart above).
• Flowable advantages of low viscosity and potentially better margin adaptation do not outweigh long-term clinical success of direct restorations afforded by proven conventional composites.
• CR will continue to monitor long-term clinical success of flowable composites for the suggested expanded uses.

What is CR?

WHY CR?
CR was founded in 1976 by clinicians who believed practitioners could confirm efficacy and clinical usefulness of new products and avoid both the experimentation on patients and failures in the closet. With this purpose in mind, CR was organized as a unique volunteer purpose of testing all types of dental products and disseminating results to colleagues throughout the world.

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1. Clinical field trials where new products are incorporated into routine use in a variety of dental practices and compared by clinicians to products and methods they use routinely.
2. Controlled clinical tests where new products are used and compared under rigorously controlled conditions, and patients are paid for their time as study participants.
3. Laboratory tests where physical and chemical properties of new products are compared to standard products.