

Strength, Radiopacity and Gloss Retention Q-Match Flow™

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Introduction:

Q-Match Flow™ (B.J.M. Laboratories Ltd.) is a new highly-filled, universal shade flowable composite indicated for all classes of direct restorations in the anterior and posterior regions in a flowable viscosity. This study compared the critical material properties of flexural strength, modulus, fracture work, compressive strength, and gloss retention of **Q-Match Flow** to **3M™ Filtek™ Supreme Flowable Restorative** from Solventum™.



Conclusion:

Q-Match Flow has excellent flexural strength, modulus and compressive strength consistent with a very strong, highly-filled flowable composite ideal for resisting occlusal chewing forces. **Q-Match Flow** is highly radio-opaque and is easily distinguishable from tooth structure on radiographs. It can also be highly polished and has clinically acceptable gloss retention after 5 years of simulated toothbrushing.

MATERIALS:

Q-Match Flow (B.J.M. Laboratories), **3M Filtek Supreme Flowable Restorative** (Solventum)

Methods:

Flexural Strength, Modulus, and Fracture Work: 2 mm x 2 mm x 25 mm bar specimens (n=5) were tested after each set of specimens had been stored in deionized water for 24 hours at 37 °C according to ISO 4049:2019. Fracture work, also called Flexural Toughness or Work to-Fracture, was automatically calculated by measuring the area under the load deflection curve giving units of J and dividing by the cross-section of the specimens. They were tested using a Shimadzu AGX-V universal test machine with a 1 mm/min crosshead speed and 20 mm span.

Compressive Strength: 4 mm diameter x 6 mm cylinder specimens (n=8) were tested after each set of specimens has been stored in deionized water for 24 hours at 37 C. Cylinders were cured for 20 seconds on the top, bottom while in the mold and sides after removal from the mold, and the ends flattened with 600-grit SiC paper. They were tested using a universal test machine (Instron 5866) with a 1 mm/min crosshead speed.

ISO 4049 Radiopacity: Specimens (n=3) were prepared to be 10 mm diameter and 1 mm thickness. Specimens were tested according to ISO 4049:2019 using an aluminum step wedge and digital sensor (Dexis Titanium).

Toothbrush Abrasion and Gloss Retention: Specimens (n=6) were prepared for toothbrush abrasion by curing composite in a 10 mm in diameter mold and 2-mm thick. They were uniformly polished through 0.25-micron diamond grit suspension paste (Buehler), and their gloss and surface roughness measured. Gloss was measured with a Novo-curve small area glossmeter at 3 angles per measurement and averaged, and surface roughness measured with a SJ-310 Profilometer (Mitutoyo) with 2 measurements per specimen using the ISO-R profile over 1.5 mm measurement length. Half of the specimens were protected with a single-sided tape and subjected to over 5 years of simulated toothbrush abrasion in a figure-8 pattern, with a 500-g (4.9 N) load and 15,000 cycles or 30,000 total strokes. Colgate medium toothbrush and **Colgate Cavity Protection** toothpaste were used. The gloss, average surface roughness (Ra) and mean roughness depth (Rz) compared to the initial state are presented in the results. ΔRa and ΔRz are calculated based on pairwise comparisons on the same sample.

Results:

Product	Flexural Strength, MPa	Flexural Modulus, GPa	Work to Fracture, kJ/m ²	Compressive Strength, MPa	Radiopacity, mm alum eq
Q-Match Flow	174 (6)	11.9 (0.2)	3.7 (0.3)	369 (15)	2.9 (0.0)
3M Filtek Supreme Flowable	146 (7)	7.7 (0.3)	4.2 (0.5)	397 (14)	1.8 (0.0)

Data presented with means (standard deviations)

Q-Match Flow has higher flexural strength, modulus and radiopacity than **3M Filtek Supreme Flowable**. This is the highest flexural strength recorded for a flowable composite in our laboratory testing and rivals the strongest packable composites. The flexural modulus of **Q-Match Flow** is also among the highest recorded for the flowable composite and is stiffer than many packable composites on the market. The compressive strength of **Q-Match Universal Flow** is within range of the compressive strength of natural tooth structure indicating it is strong enough to withstand compressive occlusal forces. The radiopacity of 290% makes this composite easily distinguishable from tooth structure on radiographs.

Toothbrush Abrasion Comparison:

Product	Toothbrush Period	Ra, nm	Rz, nm	ΔRa	ΔRz	Gloss, qu	ΔGloss, qu
Q-Match Flow	Initial	28 (3)	332 (72)	23 (9)	218 (74)	85.9 (3.2)	-13.0 (1.6)
	15,000 cycles	51 (1.1)	550 (119)			72.9 (4.5)	
3M Filtek Supreme Flowable	Initial	17 (4)	168 (41)	6 (3)	105 (53)	94.0 (2.4)	-3.3 (1.6)
	15,000 cycles	23 (5)	272 (49)			90.7 (3.0)	

Both composites retained a clinically acceptable gloss after toothbrush abrasion (>70 qu) and maintained below 100-nm average roughness value to minimize bacterial adhesion.

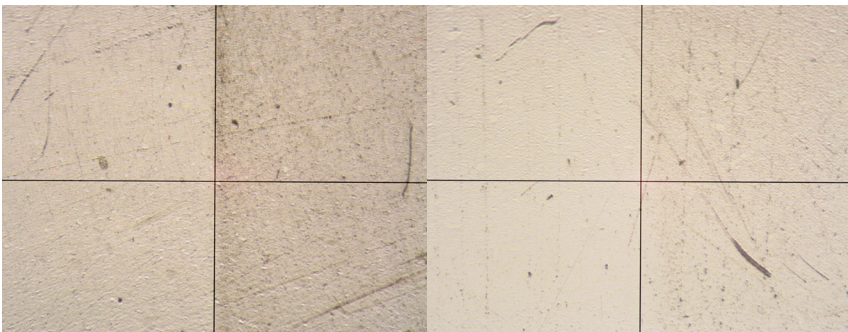


Fig. 1. Images taken with a light microscope and 2 mm FOV after toothbrush abrasion with the initial polished side on the left, and toothbrush abraded side on the right. Composites ordered from left to right: **Q-Match Flow**, **3M Filtek Supreme Flowable**.