Fact File

Spectra ST
Universal Composite Restorative

Spectra ST flow
Flowable Composite Restorative

Spectra ST[1] is the latest innovation in universal hybrid composites from Dentsply Sirona for anterior and posterior restorations available in three different viscosities: high viscosity (HV), low viscosity (LV), and flowable. While LV contains a slightly lower filler load than HV without affecting its physical properties, **Spectra ST flow**[1] has a reduced filler content to offer higher flow characteristics. **Spectra ST** and **Spectra ST flow** are based on the patented SphereTEC® filler technology providing optimized handling properties and predictable esthetics. Thanks to its pronounced chameleon effect, only five universal CLOUD shades (A1-A4) are needed to match the full VITA® range. An additional Bleach White shade (BW) is available to restore bleached teeth. The innovative SphereTEC® fillers are spherical pre-polymerized fillers with a mean size of 15 µm that are obtained via a spray-granulation process from submicron glass fillers. The spherical form leads to a ball-bearing like effect, which results in high slump resistance but at the same time easy sculptability and adaptation to the cavity. The microstructure of the SphereTEC® fillers binds via capillary effect more free resin than usual fillers enabling a low stickiness to hand instruments. Results from studies with **Spectra ST** and **Spectra ST flow** revealed high flexural strength and excellent handling properties in combination with fast and easy polishing as well as low wear of **Spectra ST** in occlusal stress bearing areas.

Flexural strength

Flexural strength is in the ISO standard 4049 the only listed parameter for testing mechanical strength of a composite. In the Research Laboratory for dental Biomaterials at Erlangen University, flexural strength was measured in a four-point bending test. The specimens were loaded until failure in a universal testing machine with a crosshead speed of 1 mm/min. Because the flexural strength changes after water storage, the initial value provides only limited information. Therefore, the specimens were measured after two weeks of water storage at 37 °C. The results showed significantly higher flexural strength for **Spectra ST** and **Spectra ST flow** than for the other composites (Figure 1).

[1] Depending on the market, Spectra ST and Spectra ST flow are available as either TPH Spectra® ST and TPH Spectra® ST flow, Ceram.x Spectra™ ST and Ceram.x Spectra™ ST flow, or Neo Spectra™ ST and Neo Spectra™ ST flow.

Dentsply Sirona
Research

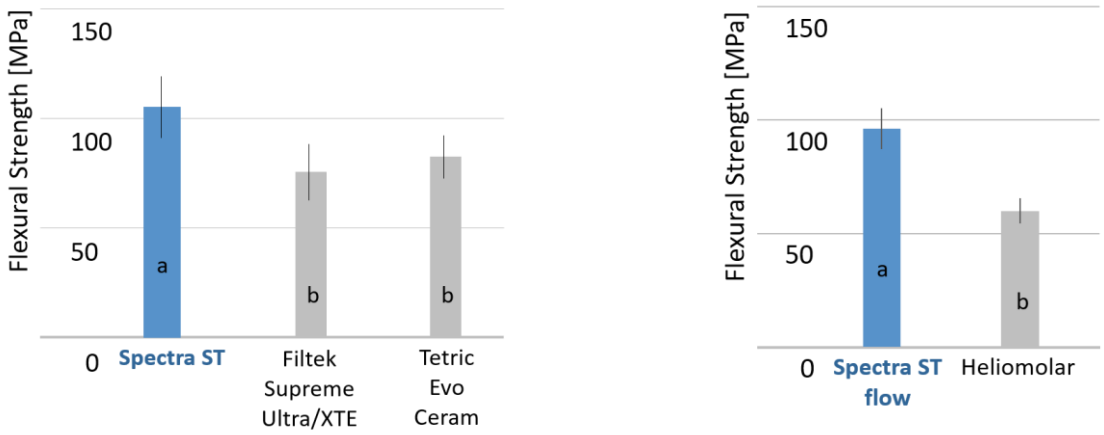

Fig. 1 Flexural strength of **Spectra ST** (left; Belli & Lohbauer 2015) and **Spectra ST flow** (right; Belli & Lohbauer 2018) in four-point bending after two weeks of water storage. Different letters indicate significant differences.

Wear

Of special interest in occlusal stress bearing cavities is, besides flexural strength, whether the material can resist chewing. The clinical process of wear is a mixture of quite complex mechanisms and currently cannot be reproduced with one single method. Therefore, at Creighton University (Omaha NE, USA) two protocols were applied to test generalized and localized wear in the so-called Leinfelder wear machine. Both protocols include loading the specimens for 400'000 cycles at 1 Hz with 80 N with a stylus that additionally rotates for 30°. To mimic the food bolus being chewed on during mastication a water slurry of 44 µm acrylic glass (PMMA) beads surrounded the specimens. To simulate generalized wear, the stylus did not contact the surface of the specimen. To simulate localized wear, a stainless steel bearing was mounted to this stylus so that it contacted the specimen. Results from the generalized and localized wear are depicted in Figure 2. **Spectra ST** showed high wear resistance resulting in both a low volume loss and a low depth of the wear facet.

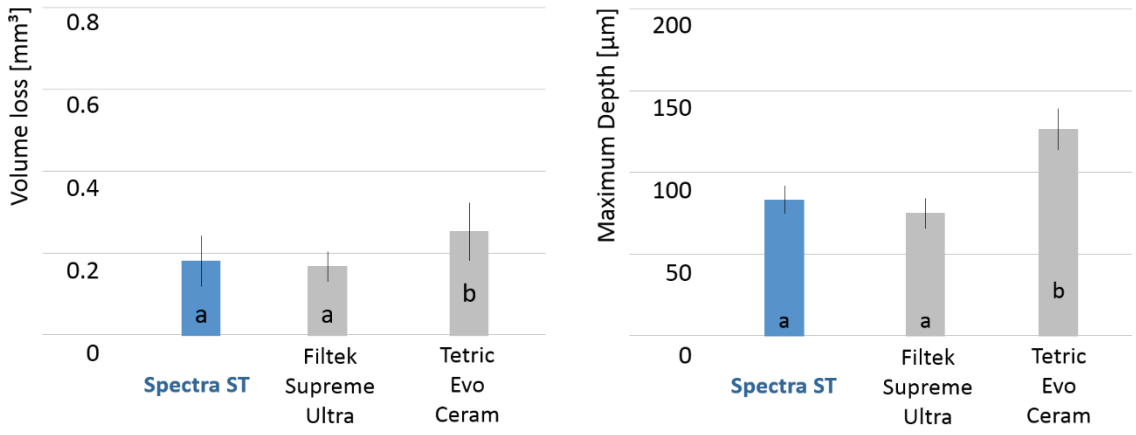

Fig. 2 Volume loss under generalized wear (left) and maximum depth of wear facets under localized wear (right). Different letters indicate significant differences (Latta 2015)

Figure 3 shows a representative scanning electron microscope (SEM) picture taken from a specimen after generalized wear. Neither the SphereTEC® granulates nor the particulate glass fillers they are made of, can be differentiated from the surrounding composite formulation. This is an indirect proof of the excellent integration of the SphereTEC® fillers into the overall composition which is essential for low wear when large pre-polymerized fillers are used.

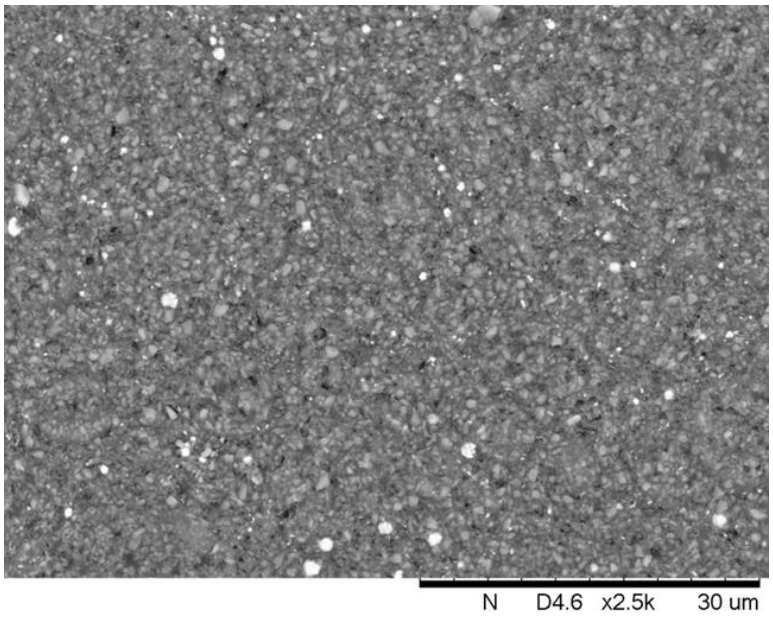

Fig. 3 SEM picture (2500x magnification) after generalized wear in the Leinfelder wear machine (Latta 2015)

Polishing

Polishing is another good test to verify how the larger SphereTEC® fillers compare to the surrounding composite formulation with its glass fillers having a mean size of 0.6 µm. All components need to be abraded equally in order to achieve high gloss in a fast and easy way. Therefore, polishing of **Spectra ST** and **Spectra ST flow** was tested following an established protocol at the Oregon Health&Science University (Portland OR, USA). Composite specimens of 5 x 12 mm size were roughened (600 grit) to obtain a standardized surface. Next, they were finished and polished with their respective polishing systems by one dentist. Gloss was measured repeatedly after 20 s until no further increase in reflexion was visible with a gloss meter. According to a publication of the American Dental Association (ADA)[2], 40 gloss units (dotted line in Figure 4) are considered to represent a clinically accepted gloss. Figure 4 shows that **Spectra ST** and **Spectra ST flow** can be finished and polished with Enhance® Finishers and Enhance® Pogo® Polishers to 40 gloss units in a shorter time compared to a composite finished and polished with Sof-Lex M, F, and SF. Moreover, the investigations revealed that **Spectra ST** and **Spectra ST flow** can be polished to a higher gloss.

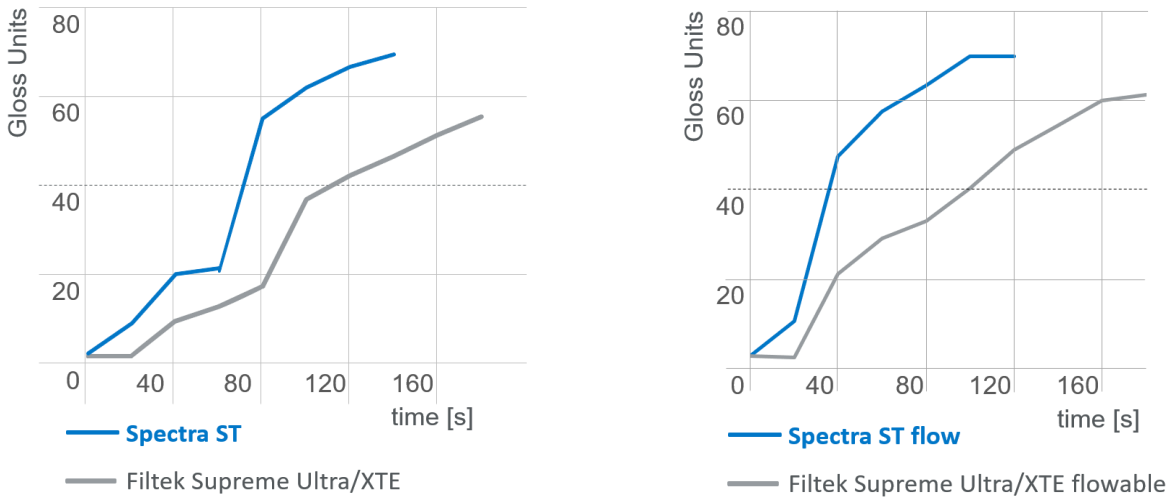

Fig. 4 Gloss over time while polishing **Spectra ST** (left; da Costa & Ferracane 2017) and **Spectra ST flow** (right; da Costa & Ferracane 2018) by using the respective polishing system.

[2] ADA professional product review. Polishing systems. 5: 2-16 (2010)

Clinical evaluations

User evaluations were conducted to test the handling properties of **Spectra ST** and **Spectra ST flow** under the condition of daily practice. Altogether, more than 170 general dentists placed over 3'100 restorations with one of the materials in 2'000 patients. The majority of the dentists preferred **Spectra ST** and **Spectra ST flow** over their currently used hybrid and flowable composite, respectively. In particular, **Spectra ST** was rated superior regarding its low stickiness to hand instruments, the good sculptability and consistency, and easier extrusion from Compules® tips. **Spectra ST flow** was primarily found to adapt easily to cavity surfaces and to offer fast and easy polishing. All this can be considered as a direct result of the SphereTEC® fillers.

Simplified layering system

For clinical situations with high esthetic demands, **Spectra ST** and **Spectra ST flow** universal CLOUD shades are complemented by two additional opacities; opaque dentin (shades D1, D3) and translucent enamel (shade E1), named **Spectra ST Effects**[3]. The universal CLOUD shades and **Spectra ST Effects** are shade/opacity variations of the same formula. When curing recommendations are followed the material data shown above are applicable for the whole shade range. Unlike other composite layering systems, the combination of a universal CLOUD and dentin shade prevents the graying-darkening often seen in Class III, IV, incisal fractures, and large posterior restorations. The universal CLOUD shades are slightly more opaque than the enamel shades typically used in other layering techniques, and thus less sensitive to the inescapable variations of layer thickness and color of the previously applied dentin layer. The simplified layering system also includes a translucent enamel shade, however, it is intended for use on the incisal third area only in order to emulate incisal effects, like halo and mamelons. Feedback from users described the simplified layering system as being a technique which is particularly easy to use and leads to reliable esthetics in a timely manner (Figure 5).

[3] Depending on the market, Spectra ST Effects is available as either TPH Spectra® ST Effects, Ceram.x Spectra™ ST Effects, or Neo Spectra™ ST Effects.

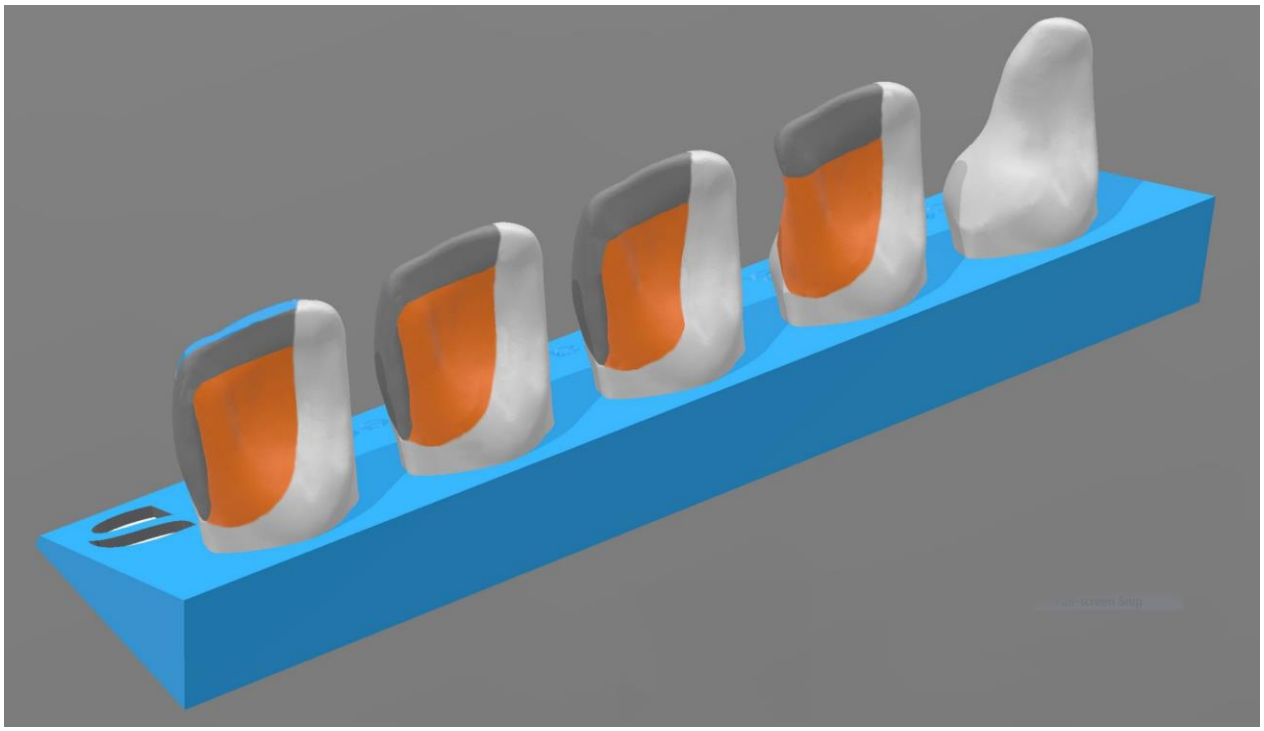

Fig. 5 Large Class IV viewed from the palatal aspect. Simplified layering system using maximum three shades (orange, dentin shade; grey, universal CLOUD shade; blue, optional enamel shade on the incisal edge).