Fact File

Spectra ST

Universal Composite Restorative

Spectra ST[1] is the latest innovation in universal hybrid composites from Dentsply Sirona for anterior and posterior restorations available in two different viscosities: low viscosity (LV) and high viscosity (HV). The low viscosity version contains a slightly lower filler load in order to reduce the viscosity without affecting its physical properties. **Spectra ST** is 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. 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** revealed very high flexural strength and low wear in occlusal load bearing areas in combination with an easy and fast polish to high gloss.

Flexural strength

Flexural strength is in the current ISO 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 4-point-bending strength test. Besides this static approach in which specimens are loaded with increasing force until fracture, dynamic loading is very helpful to better predict long-term stability. This fatigues the material in a similar manner to that seen in daily chewing. In this approach, specimens were loaded up to 10'000 cycles at a frequency of 0.5 Hz. If the specimen survived the challenge, the force for the next specimen was increased. In contrast, force was decreased if the specimen had been broken. Both measurements demonstrated significantly higher flexural strength for **Spectra ST** than for the other composites investigated making it suitable for both direct and indirect composite restorations, e.g. partial crowns. (Figure 1)

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

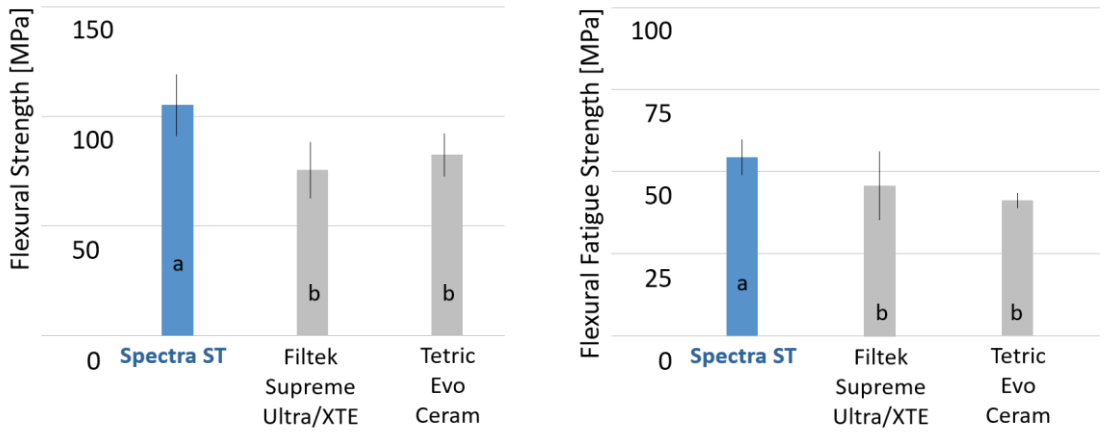

Fig. 1 Flexural strength in 4-point bending after two weeks of water storage (left) and after fatigue loading (right). Different letters indicate significant differences (Belli R & Lohbauer U, 2015)

Wear

Of special interest in posterior teeth is, besides mechanical strength, whether the material can resist chewing without loss of vertical height. 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, respectively. 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 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. To mimic the food bolus being chewed on during mastication a slurry of about 44 µm small acrylic glass (PMMA) beads surrounded the specimen in both protocols throughout the experiment (Figure 2).

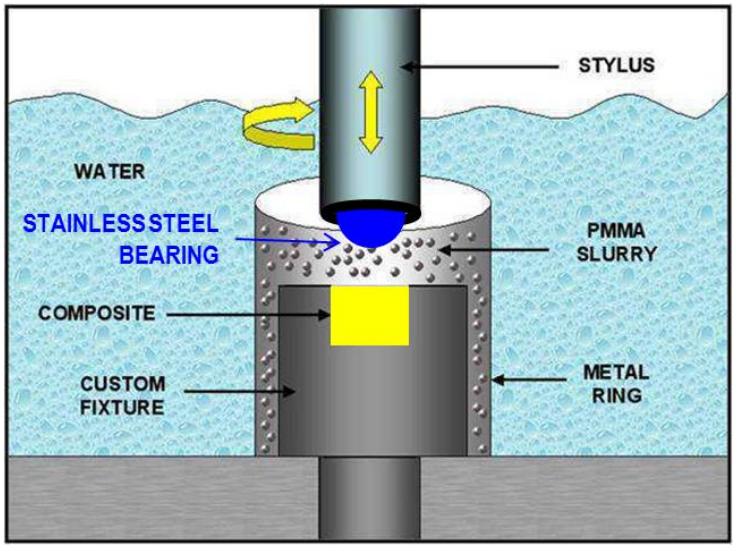

Fig. 2 Localized wear in a Leinfelder wear machine (Latta MA & Barkmeier W, Omaha NE, USA)

Results from the generalized and localized wear in the Leinfelder wear machine are depicted in Figure 3. **Spectra ST** showed high wear resistance resulting in both a low volume loss and a low depth of the wear facet.

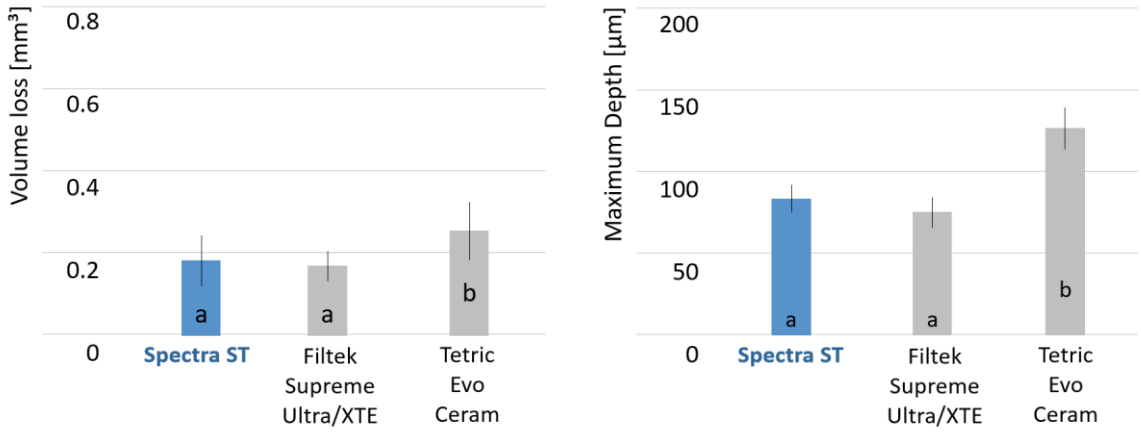

Fig. 3 Volume loss under generalized wear (left) and maximum depth of wear facets under localized wear (right). Different letters indicate significant differences (Latta MA, 2015)

Figure 4 shows a representative scanning electron microscopy 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.

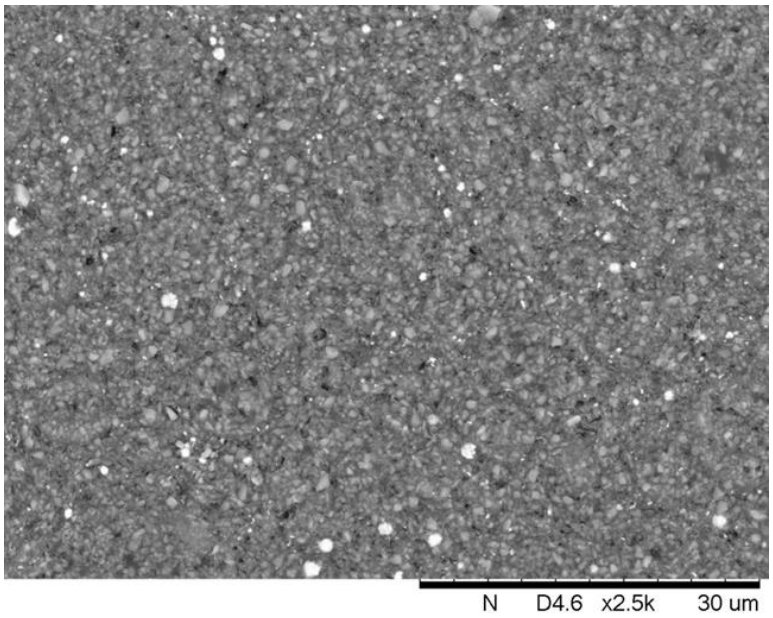

Fig. 4 Scanning electron microscopy after generalized wear in the Leinfelder wear machine (Latta MA, 2015)

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, the polishing properties of **Spectra ST** were 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 by one dentist using two different polishing systems. Gloss was measured repeatedly after 20 s until no further increase in reflection was visible with a gloss meter. According to a publication of the American Dental Association (ADA)[2], 40 gloss units (dotted line in Figure 5) are considered to represent a clinically accepted gloss.

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

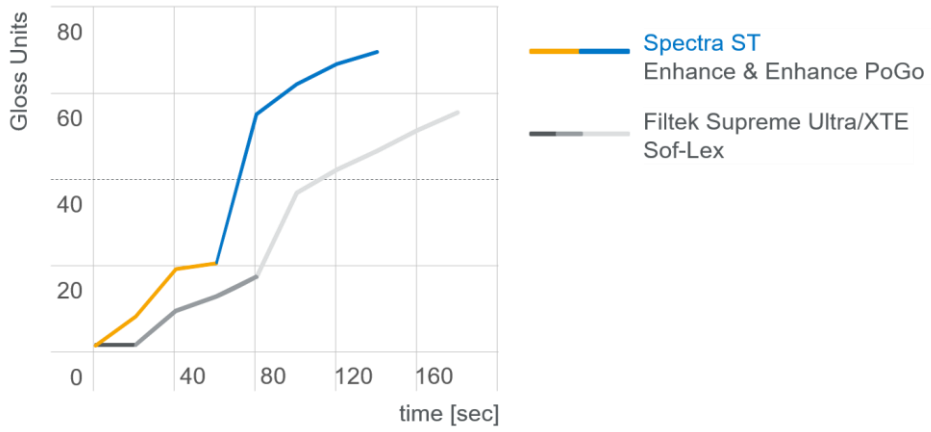

Fig. 5 Gloss over time while finishing (yellow and dark gray lines) and polishing (blue and light gray lines) composites with two different polishing systems (da Costa J & Ferracane J, 2017)

Figure 5 shows that **Spectra ST** can be finished and polished with Enhance® Finishers and Enhance® Pogo® Polishers to 40 gloss units in a shorter time and fewer steps compared to the control. Moreover, the study revealed that **Spectra ST** can be polished to a higher gloss.

Clinical evaluation

In a user evaluation under the condition of daily practice more than 130 general dentists placed at least 10 restorations in five patients with **Spectra ST**, each. Altogether, more than 2'200 restorations were placed in 1'300 patients. The majority of the dentists preferred the overall handling properties of **Spectra ST** over their currently used hybrid composites. 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. All this can be considered as a direct result of the SphereTEC® fillers used in **Spectra ST**.

Simplified layering system

For clinical situations with high esthetic demands, **Spectra ST** is complemented by two additional opacities; opaque dentin (shades D1, D3) and translucent enamel (shade E1), named **Spectra ST Effects**[3]. **Spectra ST** universal CLOUD shades and **Spectra ST Effects** are shade/opacity variations of the same formula. When curing recommendations are followed the material data

[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.

shown above are applicable for the whole shade range. Unlike other composite layering systems, the combination of a universal CLOUD shade 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 6).

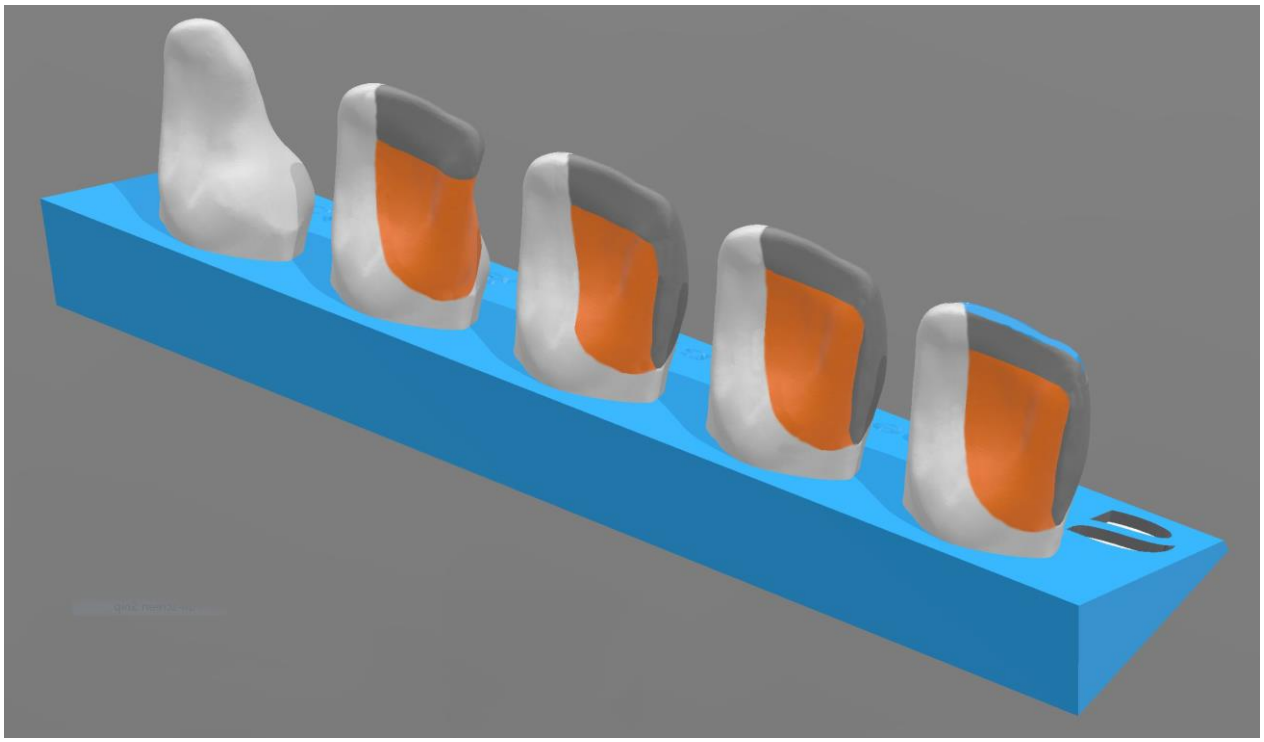

Fig. 6 Large Class IV viewed from the palatal aspect. Simplified layering system using maximum three shades (orange, dentin shade; grey, universal CLOUD shade; blue, optional enamel shade on the incisal edge)

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