Fact File

TPH Spectra® ST

Universal Composite Restorative

TPH Spectra® ST is the new universal hybrid composite from Dentsply Sirona for anterior and posterior restorations. As with the well-established predecessor TPH Spectra® two different viscosities (low and high) are available. The low viscosity version contains a slightly lower filler load in order to reduce the viscosity without affecting its physical properties. **TPH 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 shades 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 the below described studies with **TPH 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 **TPH Spectra® ST** than for the other composites investigated making it suitable for both direct and indirect composite restorations, e.g. partial crowns. (Figure 1)

Dentsply Sirona

Research

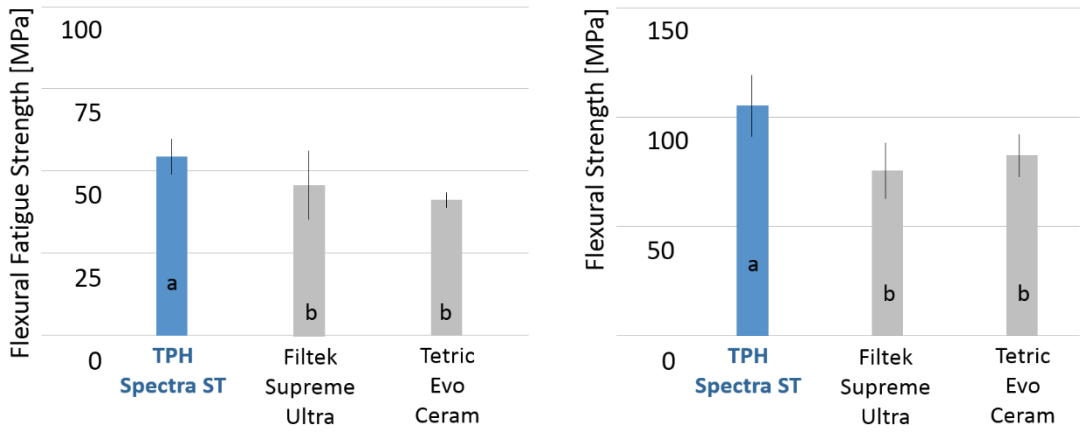

Fig. 1 Flexural strength in 4-point bending after two weeks of water storage (left) and after fatigue loading (right). Different letters indicate significant differences (Belli R & Lohbauer U, 2015)

Wear behavior

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).

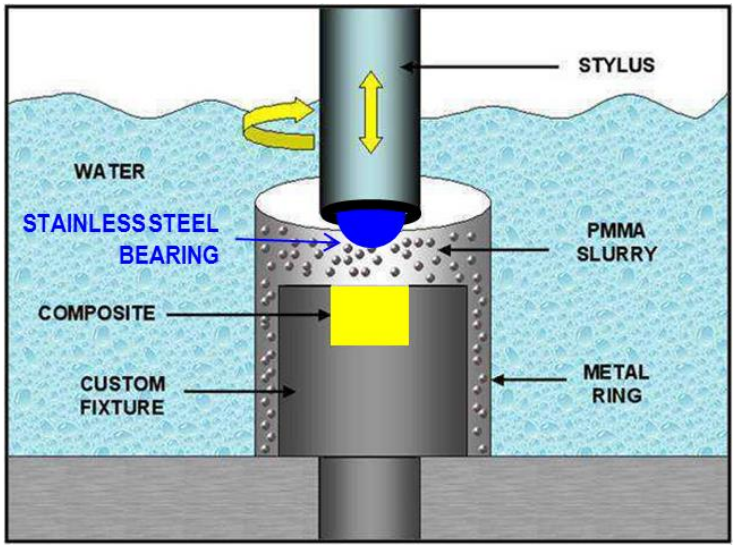

Fig. 2 Localized wear in a Leinfelder wear machine (Latta MA & Barkmeier W, Omaha NE, USA)

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

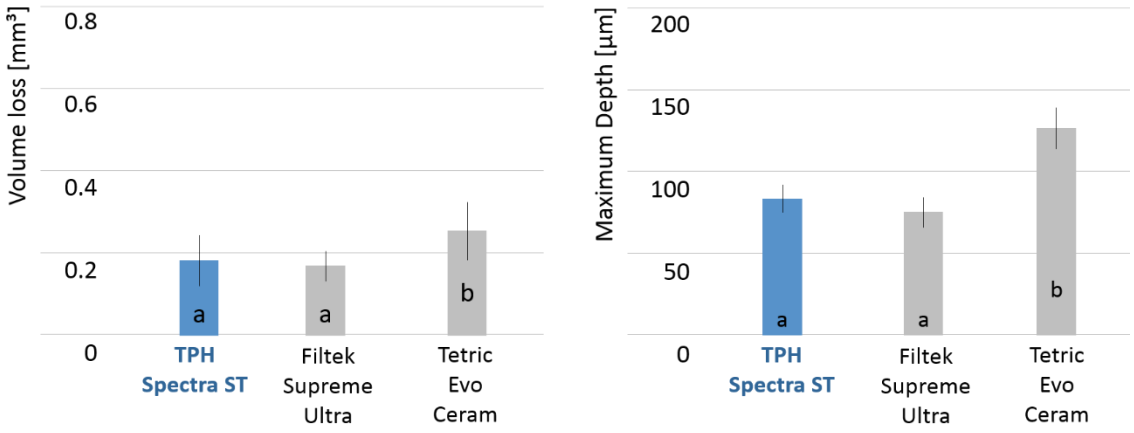

Fig. 3 Volume loss (left) and maximum depth of wear facets (right) in the Leinfelder wear machine. Different letters indicate significant differences (Latta MA, 2015)

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.

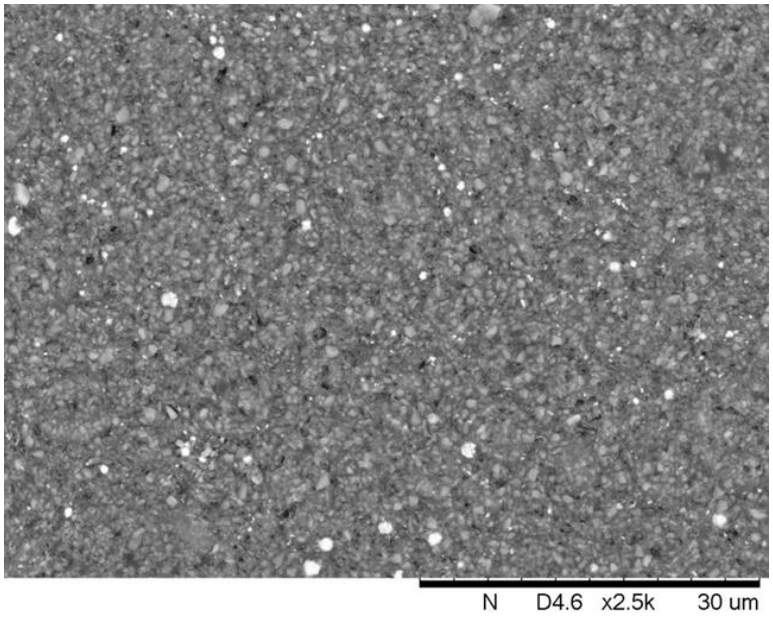

Fig. 4 Scanning electron microscopy after generalized wear in the Leinfelder wear machine (Latta MA, 2015)

Polishing properties

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 **TPH 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 reflexion was visible with a gloss meter. According to a publication of the American Dental Association (ADA)[1], 40 gloss units (dotted line in Figure 5) are considered to represent a clinically accepted gloss.

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

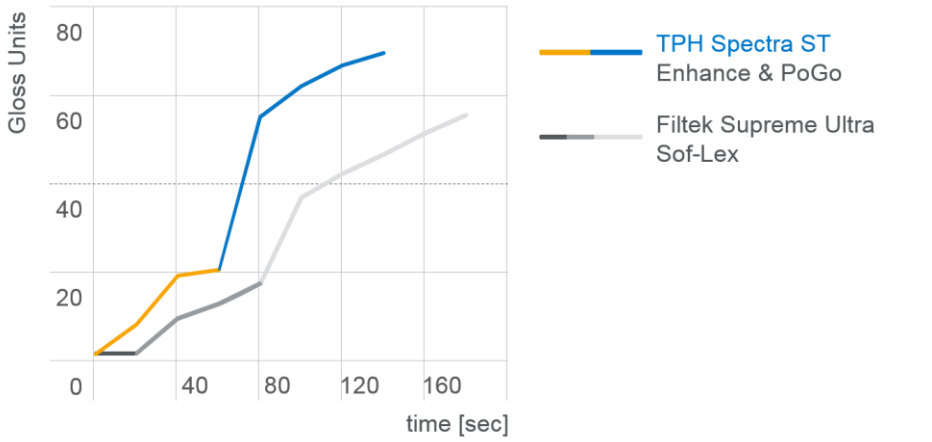

Fig. 5 Gloss over time while finishing (yellow and dark gray lines) and polishing (blue and light gray lines) composites with two different polishing systems (da Costa J & Ferracane J, 2017)

Figure 5 shows that **TPH 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 **TPH Spectra® ST** can be polished to a higher gloss.

Clinical evaluation

In a recent user evaluation under the condition of daily practice more than 130 general dentists currently using TPH Spectra® or another universal hybrid composite each placed at least 10 restorations in five patients with **TPH 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 **TPH Spectra® ST** over their current composite. In particular, **TPH 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 **TPH Spectra® ST**.