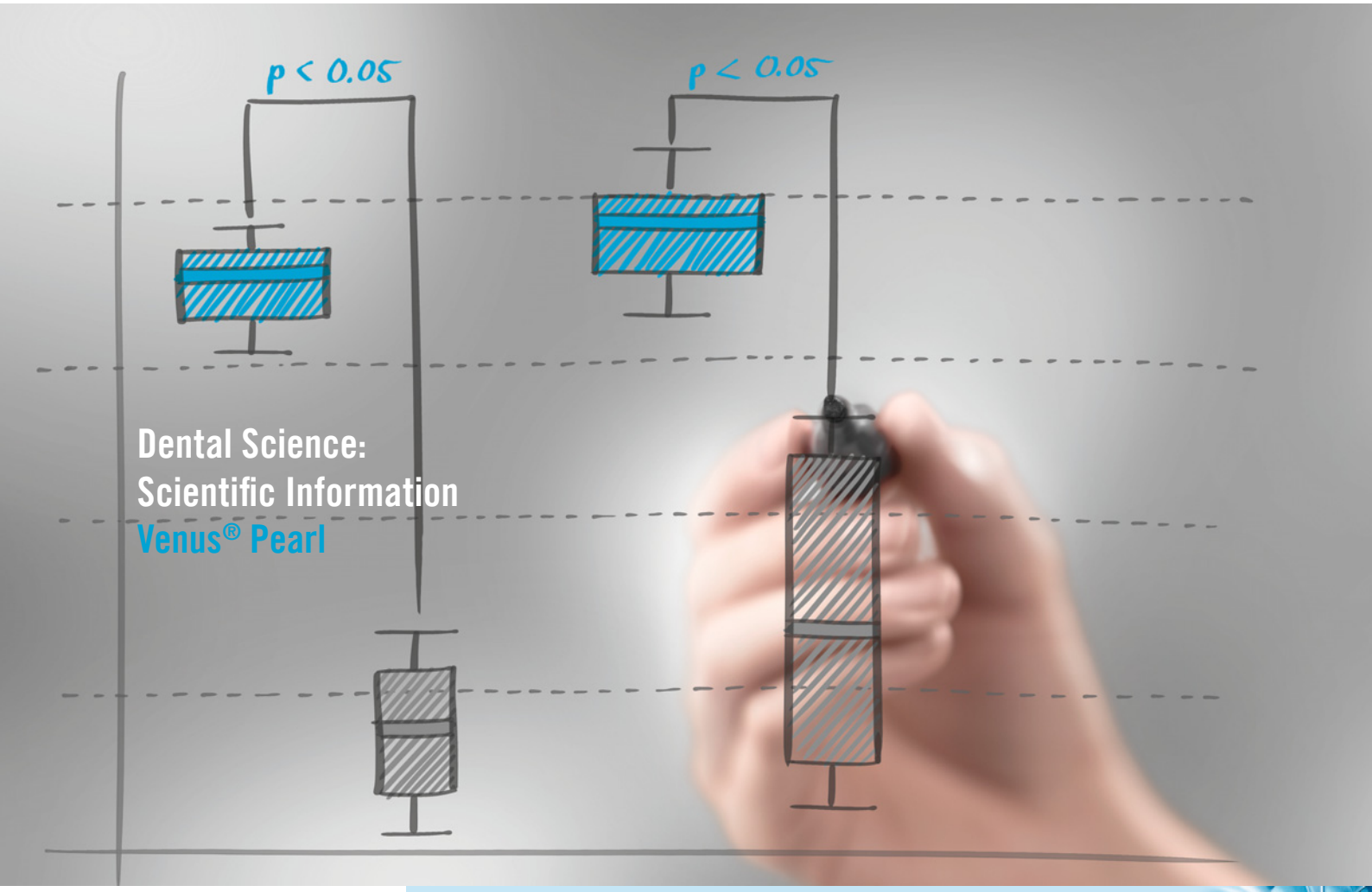
Heraeus Kulzer
Mitsui Chemicals Group



Dental Science: Scientific Information
Venus® Pearl

Venus®

Strength testing – University of Regensburg, Germany
Fracture toughness of different composite materials.

Fractures and secondary caries are still the main reasons for failure of restorations[1]. Therefore, a resin based composite material needs to resist high forces during mastication. Fracture toughness of different composite materials is one of the tests to evaluate the strength of a material. It investigates the resistance of a material to the propagation of a present crack or void which can be accidentally created during restoration placement. It is discussed that fracture toughness may correlate with intra-oral chipping of surfaces and margins[2,3]. The best current composites have fracture toughness values below 2.0 MPa $m^{1/2}$ which is similar to amalgam and better than porcelain[4].

Venus Pearl achieved an outstanding high average fracture toughness value of 2.5 MPa $m^{1/2}$ in the presented study by PD Dr. Martin Rosentritt from the University of Regensburg, Germany. A high fracture toughness may minimise the risk of chipping the restoration in the long run.

Giving a hand to oral health.

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Objective

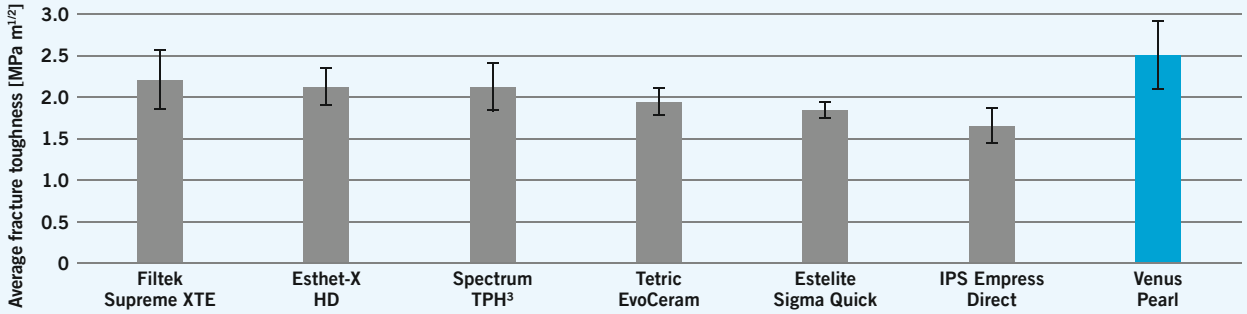
Aim of this investigation was to compare the fracture toughness of different nano-hybrid composites.

Materials and Methods

The tested resin based composites were Filtek Supreme XTE (3M ESPE), Esthet-X HD, Spectrum TPH³ (both Dentsply), Tetric EvoCeram, IPS Empress Direct (both Ivoclar Vivadent), Estelite Sigma Quick (Tokuyama) and Venus Pearl (Heraeus Kulzer). Of each composite 10 rod-shaped specimens (25x5x2.5 mm) were manufactured and light cured for 40 seconds with an Elipar S10 (3M ESPE). Specimens were stored in distilled water (37 °C) for 7 days. A notch was engraved on the narrow long side of the rods (1.5 mm depth, 0.5 mm thickness) by a diamond saw (Diadisc 4200, Mutronic Präzisionsgerätebau). At the deepest point of the notch, a crack (0.2 mm length) was prepared using a razor blade (Classico, Wilkinson) in a pneumatic guillotine. Height and width of the specimens were measured close to the notch together with the length of the crack by a stereo microscope (SV8, Zeiss). Afterwards a 3-point-bending test was performed with all specimens in a universal testing device (Zwick 1446, Zwick) using a preload of 1N and a crosshead speed of 0.25 mm/min until fracture. Fraction force and deflection until fracture were recorded and fracture toughness was calculated. Average and standard deviation were calculated and statistics were performed using an ANOVA and Bonferroni-test (p=0.05, SPSS).

Results

Venus Pearl displays outstanding high fracture toughness



Statistical tests revealed significant differences between materials (p=0.000). Venus Pearl showed significant higher values than all other materials. Filtek Supreme XTE, Esthet-X HD and Spectrum TPH³ were on similar levels followed by the third group of composites IPS Empress Direct, Estelite Sigma Quick and Tetric EvoCeram.

Conclusion

Evaluated materials indicate different fracture toughness values. The results could be a function of the composition and polymerisation but also of notch variations. Highest fracture toughness was found for Venus Pearl followed by Esthet-X HD, Filtek Supreme XTE and Spectrum TPH³.

Source

Rosentritt M: Bestimmung der bruchmechanischen Werkstoffgröße. Test report August 2012. Unpublished data. Data on file.
The study was abbreviated and summarised and all diagrams and titles have been established by Heraeus Kulzer.
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[2] Tyas MJ: Correlation between fracture properties and clinical performance of composite resins in class IV cavities. Aust Dent J, 1990, 35:46-9
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[4] Freeacane JL: Resin composite state of the art – Review. Dent Mat, 2011, 27: 29-38

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