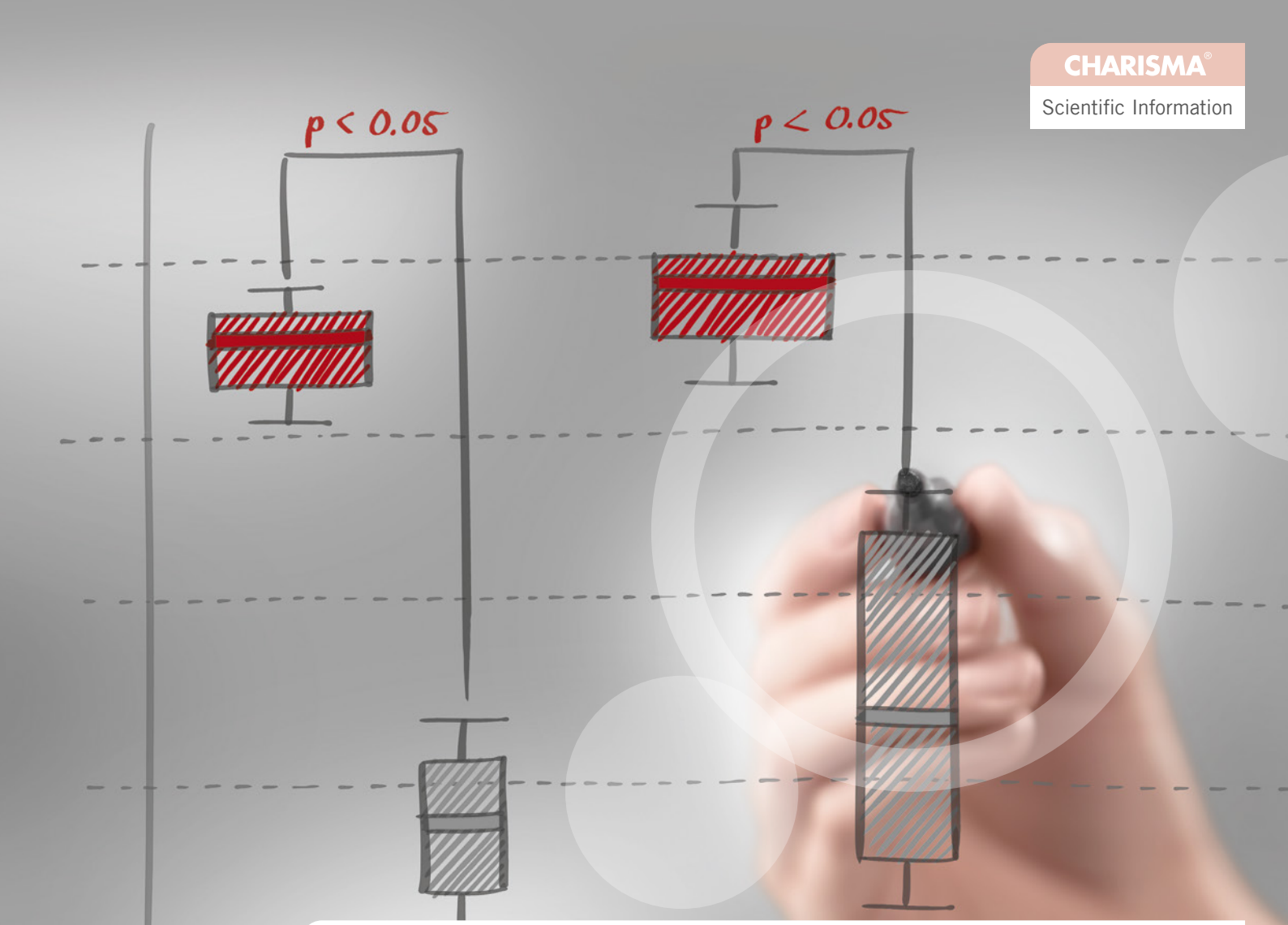


Charisma Diamond

Mechanical strength – University of Campinas, Brazil
Evaluation of physico-mechanical properties and filler particles characterization of conventional, bulk-fill, and bioactive resin-based composites

Dental resin-based composites are constantly being advanced and formulas among and even within manufacturers vary greatly. The composition, especially the employed organic matrix and the features of the filler particles, like size, composition and content, have a strong impact on the physical and mechanical properties of the material. Therefore, it is essential to continuously assess the laboratory and clinical performances of these products in order to enable practitioners to make an informed choice about their preferred materials.

The University of Campinas performed several in vitro studies to evaluate the physical and mechanical properties of seven different dental composites available in the market. Flexural strength tests were performed, assessing the materials' ability to withstand masticatory stress and therefore indicating durability of restorations. Water sorption and solubility were also measured. In the hydrous environment of the oral cavity, excessive water sorption can lead to expansion of restorations, which may cause stress on the tooth, fractures or postoperative sensitivities. Minimal solubility is also advantageous, meaning less mechanical degradation and leakage of residual monomers into the oral cavity.

The research at hand once again confirms the good mechanical properties that Charisma Diamond has already exhibited in various studies.

Giving a hand to oral health.

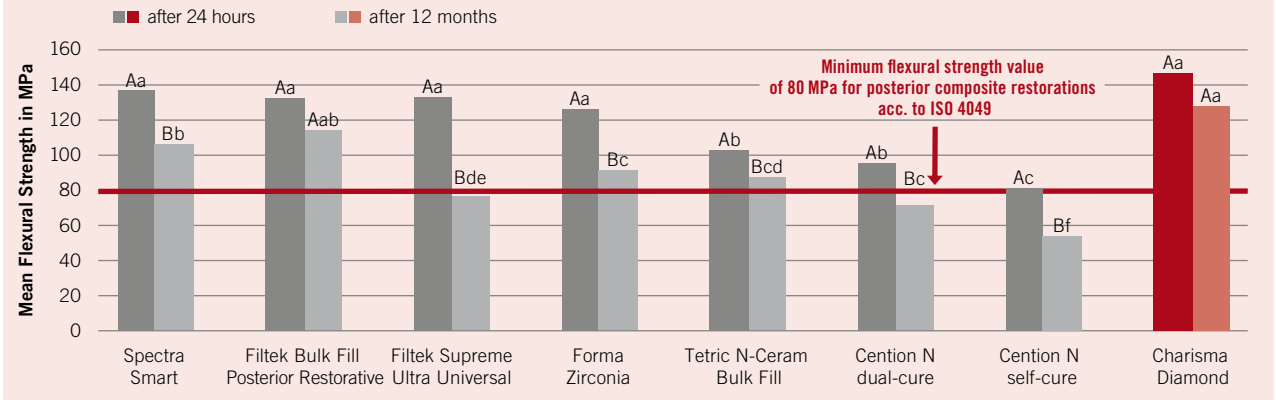
KULZER
MITSUI CHEMICALS GROUP

Mechanical strength – University of Campinas, Brazil
Evaluation of physico-mechanical properties and filler particles characterization of conventional, bulk-fill, and bioactive resin-based composites

Objective
The aim of this study was to evaluate the physical properties of seven composites.

Materials & Methods
The tested composites were Spectra Smart (Dentsply Sirona), Filtek Bulk Fill Posterior Restorative and Filtek Supreme Ultra Universal (both 3M Oral Care), Forma Zirconia (Ultradent do Brasil), Tetric N-Ceram Bulk Fill (Ivoclar Vivadent), Cention N in self-cure and dual-cure modes (Ivoclar Vivadent) and Charisma Diamond (Kulzer). Fourty disk-shaped specimens (n = 5) were prepared for water sorption and solubility tests. A 3-point bending test was performed after 24h and 12 months water storage to measure flexural strength. The degree of conversion and maximum rate of polymerisation were evaluated using micro-Raman spectroscopy throughout 40 seconds of light curing. Statistical analyses were performed using 1-way or 2-way ANOVA followed by Dunn's or Tukey's post hoc tests ($\alpha = 0.05$).

Results
Charisma Diamond maintains a high resilience towards masticatory forces over time



Same letters did not present a statistically significant difference between groups ($p > 0.005$). Uppercase letters compare the same composite after 24h and 12 months, while lowercase letters compare different composites at the same evaluation time.

Charisma Diamond exhibited a high mean degree of conversion at 91.1 ± 1 % and a mean maximum polymerisation rate of 8.2 ± 2.4 %/s. It had a mean water sorption of 12.4 µg/mm³ and a solubility of 5.4 µg/mm³. The highest water sorption was found for Filtek Supreme Ultra Universal with a mean of 25 µg/mm³. Charisma Diamond and Filtek Bulk Fill Posterior Restorative were the only materials showing no statistically significant drop in flexural strength between both evaluation times. Charisma Diamond and Filtek Bulk Fill Posterior Restorative had the significantly highest flexural strength after one year.

Conclusion
Matrix composition and filler properties show a significant impact on the physico-mechanical properties of the evaluated dental composites. Charisma Diamond emerges as the most stable material amongst the tested composites.

Comment
Charisma Diamond keeps mechanically stable over time. This is caused by the high degree of conversion of its TCD-urethane matrix and its low water sorption and solubility. All this leads to a high flexural strength, which is one of the pre-requisites to minimise the risk of restoration chipping and fractures. Unlike some other tested materials, Charisma Diamond vastly exceeds the minimal requirement of 80 MPa of flexural strength even after a year of storage. Clinicians will enjoy the advantages of Charisma Diamond's excellent mechanical properties and be confident in the longevity of their restorations.

Source
Gomes de Araújo-Neto V *et al.* Evaluation of physico-mechanical properties and filler particles characterization of conventional, bulk-fill, and bioactive resin-based composites. J Mech Behav Biomed Mater. 2021 Mar;115:104288.

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