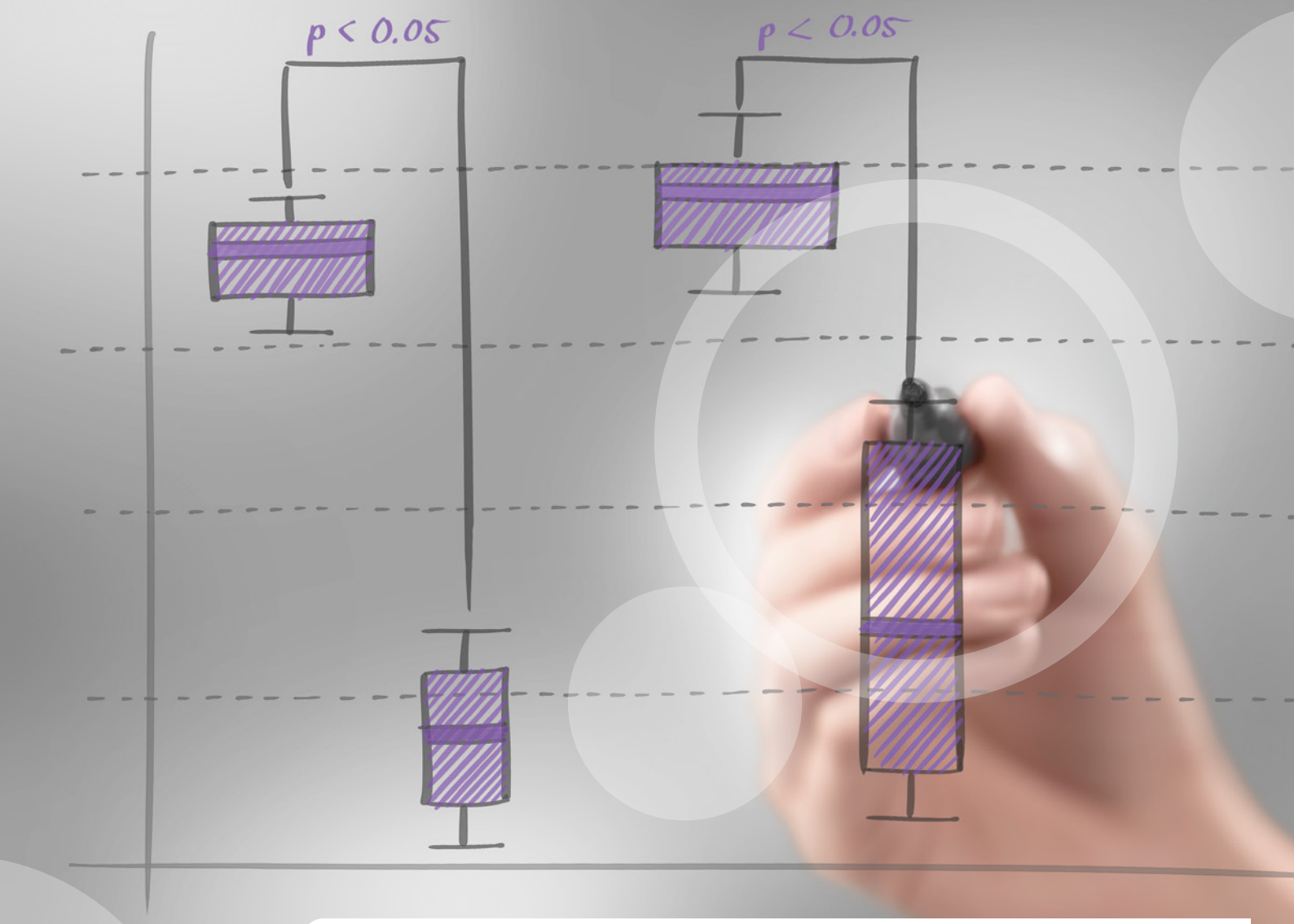
dima®
Scientific Information



dima Print Teeth & Temp

Mechanical Properties of 3D-Printed Provisional Material Compared to Milled Material

In vitro study – Kulzer R&D

3D-Printing technology and computer numerical control (CNC) milling machines are the most common computer-aided manufacturing methods in the dental field. While milling devices produce a workpiece using the subtractive technique, 3D-Printing is based on additive processes.[1]

In addition to numerous other indications, fabricating long-term temporaries using computer-aided manufacturing methods is increasingly important. According to the corresponding requirements, these materials must exhibit stable and durable properties.[2]

This investigation compares the mechanical properties of a new photopolymer dima Print Teeth & Temp with milled provisional crown-and-bridge materials.

Giving a hand to oral health.

KULZER
MITSUI CHEMICALS GROUP

[1] Park SM *et al.*: Flexural Strength of 3D-Printing Resin Materials for Provisional Fixed Dental Prostheses. Materials (Basel). 2020 Sep 8;13(18):3970. DOI: 10.3390/ma13183970.

[2] Gernet W *et al.*: Provisorische Versorgung. In: Zahnärztliche Prothetik. 2011. DOI: 10.1055/b-0034-18214

Mechanical Properties of 3D-Printed Provisional Material Compared to Milled Material

In vitro study – Kulzer R&D

Objectives

This investigation compares the mechanical properties of a new photopolymer with a milled provisional crown-and-bridge material by measuring flexural strength, elastic modulus, water sorption and solubility.

Methods

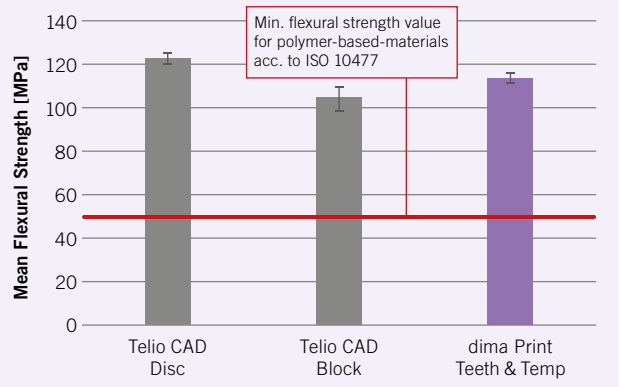
The tested provisional materials were dima Print Teeth & Temp (Kulzer GmbH), Telio CAD Disc and Telio CAD Block (both Ivoclar Vivadent GmbH).

Bar shaped specimens (n = 5/material) were produced for flexural strength testing and stored in water (24 h, 37 °C) before testing. 3-point bending was performed according to ISO 10477 with a universal testing device (Zwick/Roell Z010) at a cross-head speed of 1 mm/min to determine flexural strength. From the same measurement elastic modulus was calculated as secant (1N to 7N).

For water sorption and solubility testing, round specimens (n = 5/material) were produced from dima Print Teeth & Temp and Telio CAD Disc. Specimens were conditioned in a desiccator (22 h, 37 °C), placed in a second desiccator (2 h, 23 °C), weighed and procedure repeated until a constant mass was achieved. Specimens were weighed again after water storage (7 days, 37 °C), and after reconditioning. Testing and calculation according to ISO 10477. Statistics were done using one-way ANOVA (LSD $\alpha = 0.05$).

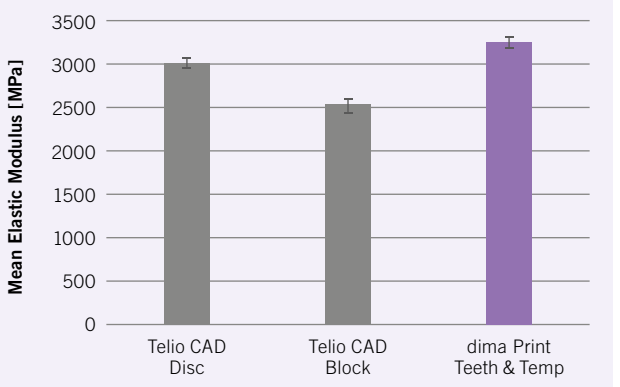
Results

dima Print Teeth & Temp shows excellent flexural strength



Mean flexural strength (standard deviation) of Telio CAD Disc was 122.7 (2.3) MPa, of dima Print Teeth & Temp was 113.8 (2.3) MPa, and of Telio CAD Block was 103.5 (5.8) MPa. The results were statistically significantly different between the materials (LSD $\alpha = 0.05$).

dima Print Teeth & Temp depicts a high elastic modulus

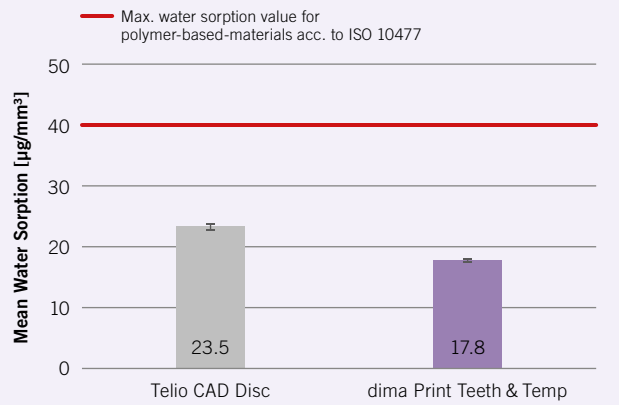


Mean elastic modulus (standard deviation) of dima Print Teeth & Temp was 3268 (49) MPa, for Telio CAD Disc 3031 (52) MPa and for Telio CAD Block 2538 (87) MPa. The results were statistically significantly different between the materials (LSD $\alpha = 0.05$). For elastic modulus no ISO requirement is stated.

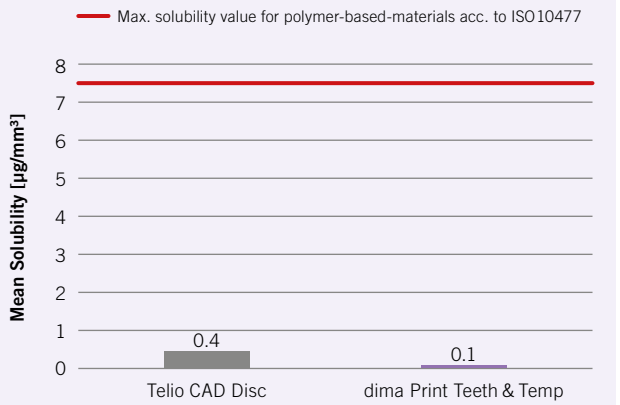
Mechanical Properties of 3D-Printed Provisional Material Compared to Milled Material

In vitro study – Kulzer R&D

dima Print Teeth & Temp presents water sorption comparable to milled temporary material



dima Print Teeth & Temp exhibits solubility below the maximum value established acc. to ISO 10477



Water sorption and solubility were not measured for Telio CAD Block. The results of water sorption were statistically significantly different between the materials (LSD $\alpha = 0.05$). All results of water sorption and solubility fulfil the ISO 10477 requirements.

Conclusion

Within the limitations of this study, it can be stated that the new photopolymer dima Print Teeth & Temp exhibits good mechanical properties comparable to those of a milled reference product.

Comment

Restorations are not only exposed to several forces in the mouth. They are also subjected to the oral environment's conditions, influencing materials' properties and longevity.[3] dima Print Teeth & Temp presents excellent resistance to fracture and elastic deformation due to its high flexural strength and elastic modulus value.[4] Water sorption may affect composite materials by reducing the wear resistance; for this reason, it is necessary that these materials uptake the least possible amount of water. Low solubility is also essential, meaning less mechanical degradation and release of residual monomers.[5]

Source

Derendorf V, Kastrati A, Loh W, Herr A: Poster 278 at the PER-IADR Oral Health Research Congress in Marseille, September 15–17, 2022.
The study was abbreviated, summarised and commented and all diagrams and titles have been established by Kulzer.

[3] Sideridou ID: Aging studies of light cured dimethacrylate-based dental resins and a resin composite in water or ethanol/water. Dental Materials. 2007;23:1142-9

[4] Arnetzl G: Neue Materialien, neue Perspektiven. Zahntech Mag 2015; 19(1): 18-25

[5] Oysaed H: Composites for use in posterior teeth: mechanical properties tested under dry and wet conditions. J Biomed Mater Res. 1986 Feb; 20(2): 261-71. doi: 10.1002/jbm.820200214

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Kulzer GmbH · Leipziger Straße 2 · 63450 Hanau · Germany · kulzer.com