Ultracur3D® DM 2505

Dental | Dental Model | Beige

Extended TDS

Complete Technical Documentation and Testing Summary

Version 2.1

Contents

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Technical Data Sheet

Rigid resin, perfect solution for dental models and molds.

General Properties	Method	Typical Values
Appearance	-	Beige
Viscosity, 25°C	Cone/Plate Rheometer[1)]	100 mPas
Viscosity, 30°C	Cone/Plate Rheometer[1)]	80 mPas
Density (Printed Part)	ASTM D792	1.2 g/cm³
Density (Liquid Resin)	ASTM D4052-18a	1.1 g/cm³

Tensile Properties[2)]	Method	Typical Values
E Modulus	ASTM D638	2200 MPa
Ultimate Tensile Strength	ASTM D638	48 MPa
Elongation at Break	ASTM D638	4%

Flexural Properties	Method	Typical Values
Flexural Modulus	ASTM D790	2150 MPa
Flexural Strength	ASTM D790	83 MPa

Impact Properties	Method	Typical Values
Notched Izod (Machined), 23°C	ASTM D256	15 J/m
Unnotched Izod, 23°C	ASTM D4812	173 J/m
Notched Charpy (Machined), 23°C	ISO 179-1	1.1 kJ/m²

Thermal Properties	Method	Typical Values
HDT at 0.45 MPa	ASTM D648	69°C
HDT at 1.82 MPa	ASTM D648	55°C
Glass transition temperature (DMA, tan(d))	ASTM D4065	108°C

Other	Method	Typical Values
Hardness Shore D	ASTM D2240	73
Water Absorption, Short-Term (24 hours)	ASTM D570	0.85%
Water Absorption, Long-Term (>600 hours)	ASTM D570	>5%

Mechanical properties overview

1) Determined with TA-Instrument DHR rheometer, cone/plate, diameter 60 mm, shear rate 100 s^{-1}
2) Tensile type ASTM D638 type IV, Pulling speed 5 mm/min
3) If not noted otherwise, all specimens are 3D printed. Samples were tested at room temperature, 23°C. ASTM sample size (L x W x H): ASTM D790 80 x 4 x10 mm, ASTM D256 63 x 3.2 x 12 mm, ASTM D4812 63 x 3.2 x 12 mm, ASTM D648 127 x 3.2 x 13 mm, ISO 179-1 80 x 4 x 10 mm

Evaluation Study – 3D Printing Accuracy

The accuracy requirements for dental applications are very high because the perfect fit to the patient's mouth is essential. In order to provide the end user with validated process parameters, Ultracur3D® DM 2505 was calibrated on the 3D dental printer Organical® 3D Print X1S from Organical® CAD/CAM. All details can be found in the Evaluation Study: 3D Printing Accuracy of Ultracur3D® DM 2505

Pressure & Temperature Resistance

The pressure and temperature performance of a material is key to enable a broad range of applications and industries. Both can have a drastic effect on mechanical properties, therefore testing under these certain conditions can give an idea of the resistance of a photopolymer.

Test Method and Specimens

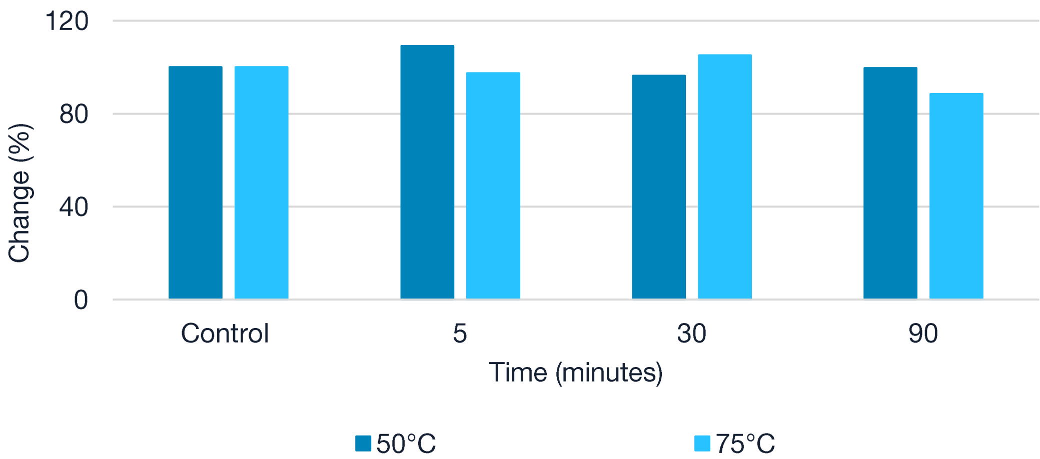
ASTM D638 type IV tensile bars and solid upper jaw dental models were immersed in water with exposed to pressure from all sides and tested according to the conditions listed below, the effect on mechanical properties was investigated.

Pressure from all sides	Temperature	Time
5 bar	50°C	5 minutes, 10 minutes, 30 minutes, 60 minutes and 90 minutes
5 bar	75°C	5 minutes, 10 minutes, 30 minutes, 60 minutes and 90 minutes

Testing conditions pressure, temperature and time

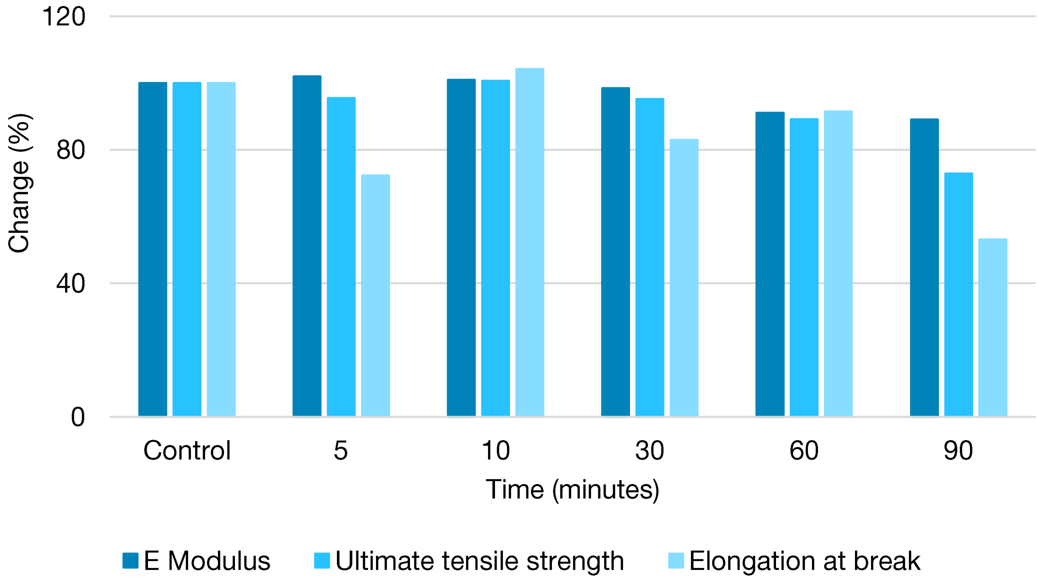
Accuracy Testing

The scan of the model after the pressure & temperature test was compared with the original STL file within +/-100 µm tolerance.

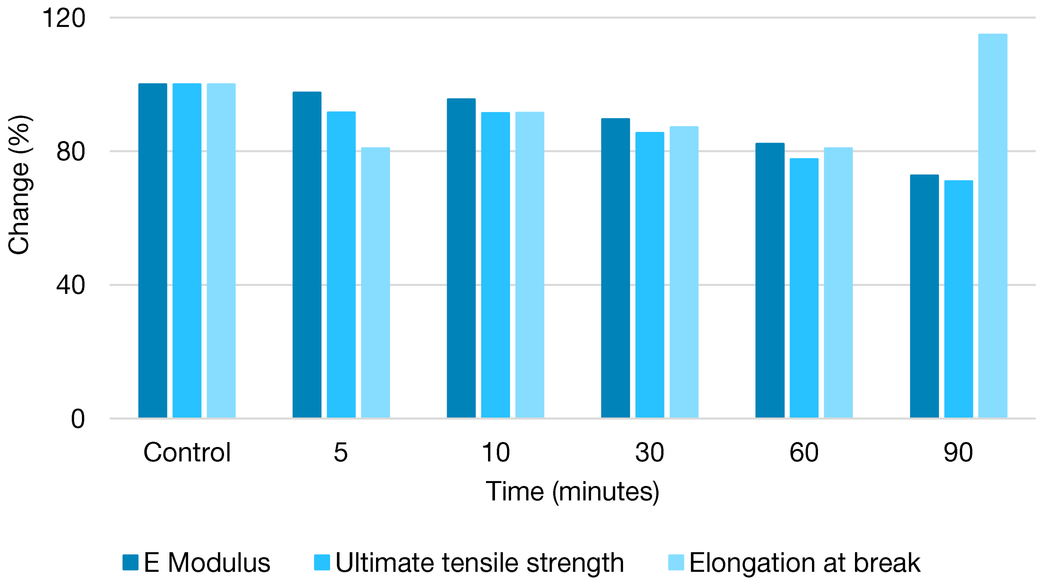


Change in accuracy, 50°C and 75°C

Mechanical Testing



Change in mechanical properties, 50°C



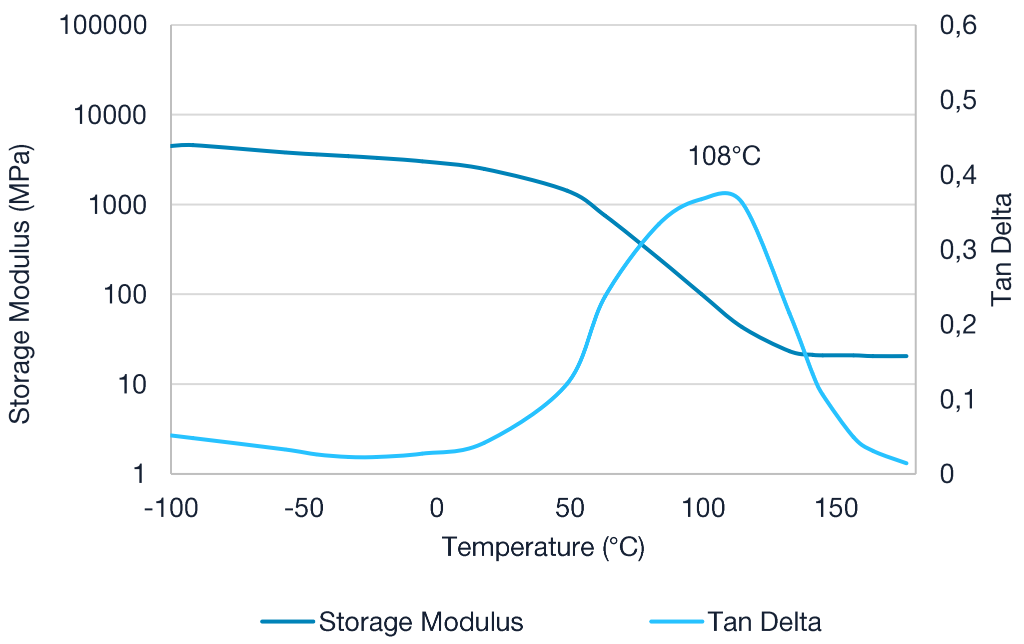
Change in mechanical properties, 75°C

Dynamic Mechanical Analysis (DMA)

In this DMA measurement, a cyclic strain is applied to the sample, and the response of the sample is recorded as a function of temperature. This can give a good impression of the changes in material behavior, both at low and high temperatures. The measured Storage modulus is a good indication of the stiffness of the material. The maximum in Tan Delta gives the glass transition temperature.

	Setting
Measurement	Strain-controlled
Temperature sweep	1°C / min
Strain	0.021% (linear viscoelastic regime)
Type of loading	Dual cantilever
Frequency	1 Hz

Testing conditions DMA



DMA curve

Accuracy for dental applications

In the dental field, the fit of dental restoration or orthodontic appliances is an important aspect. To make sure the appliance or restoration fits well in the patient's mouth, the accuracy of the part needs to be ensured. With 3D printing, we can scan and compare the printed parts with the original designed file. This document demonstrates the high accuracy that can be achieved with Ultracur3D® DM 2505 for dental models, as well as the performance and accuracy when using these models for thermoforming.

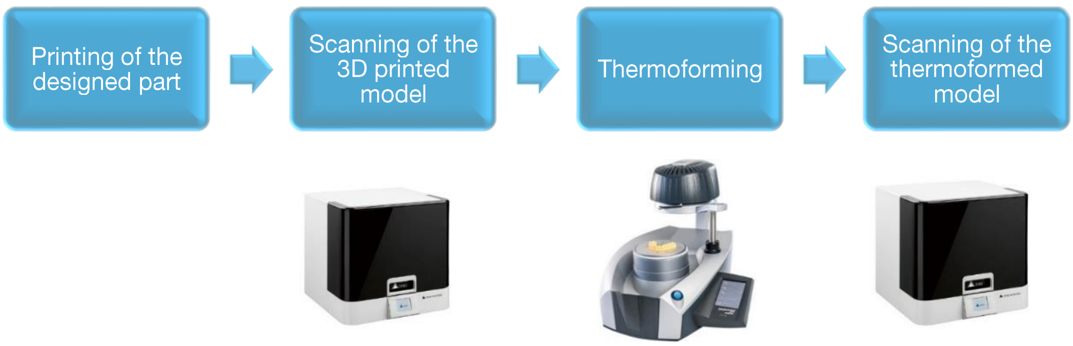
Test Method and Specimens

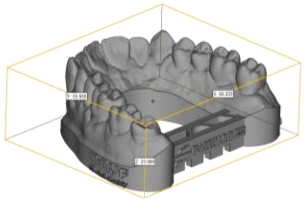
For printing Ultracur3D® DM 2505 , a MiiCraft Ultra 125 Y printer was used. Print parameters and post-processing was done as described in the corresponding User Guideline of the material. For scanning we used the FINOSCAN MOTION HR scanner.

To see if a material is suitable for thermoforming, different types of models were printed and thermoformed with a 1 mm thick foil at 160°C.

Device: Erkoform 3d +
Foil Name: Erkodur
Used Foil: 1 mm
Temperature: 160°C
Cooldown: 45 seconds

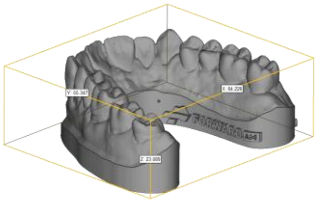
The overall process for evaluating the dental model materials is as following:





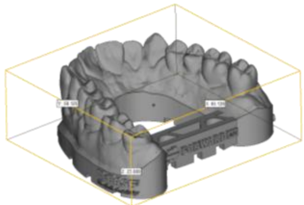
Demo Model 1:

Upper jaw, solid design with a connector for extra support.



Demo Model 2:

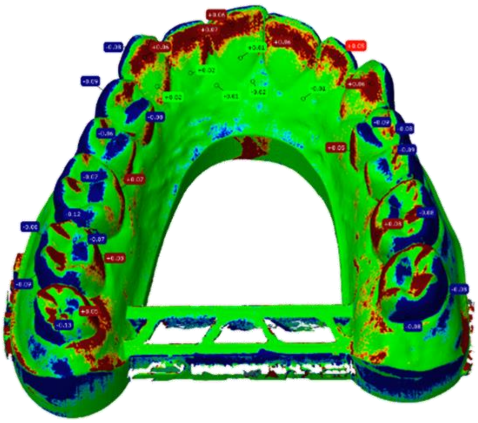
Upper jaw, solid design without a connector.



Demo Model 3:

Upper jaw, hollow design with 2.5 mm wall thickness and with a connector for extra support.

Scan explanation

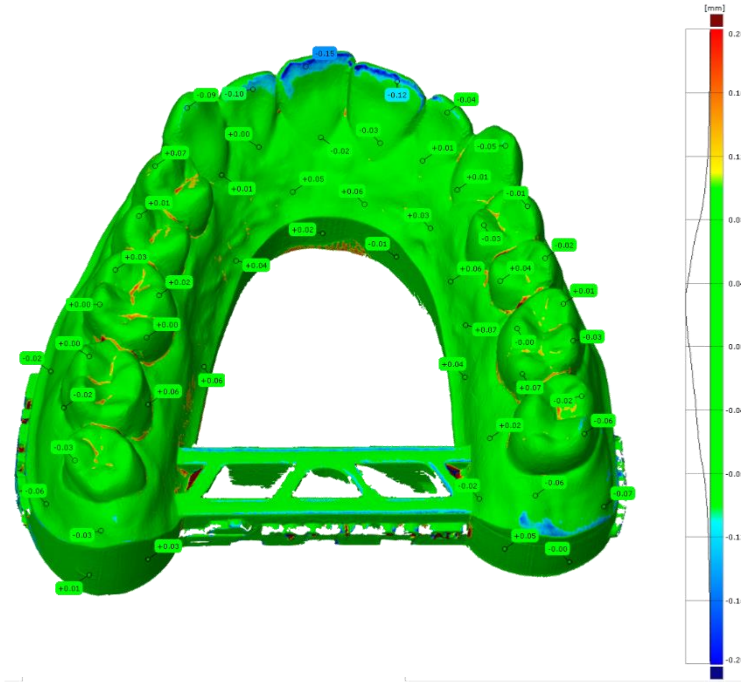


For the scan comparison, the original STL file and the printed part will be loaded in a software and compared. With this comparison, it can be seen how much deviation the printed part has to the original STL file. The blue areas show that there is not enough material while the red areas show there is too much. As an example, in the picture on the right, it shows that we have an x and y shrinkage problem. The red and blue parts are evenly spread over the model. Note that some areas of the scanned part are not shown, this is usually due to not properly spraying the surface of the printed part, some sort of reflection or a difficult angle.

For the thermoforming tests, the scan of the thermoformed part was compared with the scan of the printed part and not with the original STL file. This way, it can be observed what exactly happens during the thermoforming process.

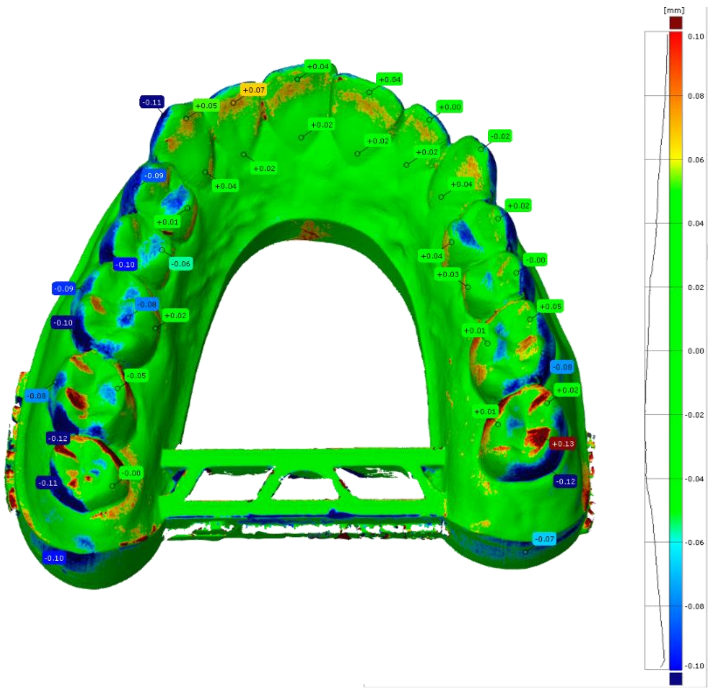
Accuracy scan test

Demo model – solid upper jaw with connector: scan of 3D **printed model** vs. **original STL**.



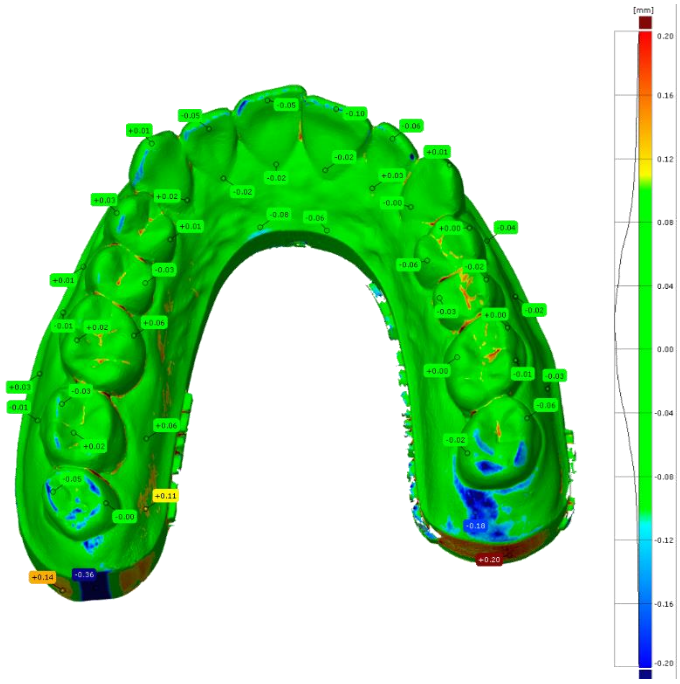
Ultracur3D® DM 2505 is within tolerance +/- 100µm (solid)

Demo model – solid upper jaw with connector: Scan **after thermoforming** vs. scan of 3D **printed model**.



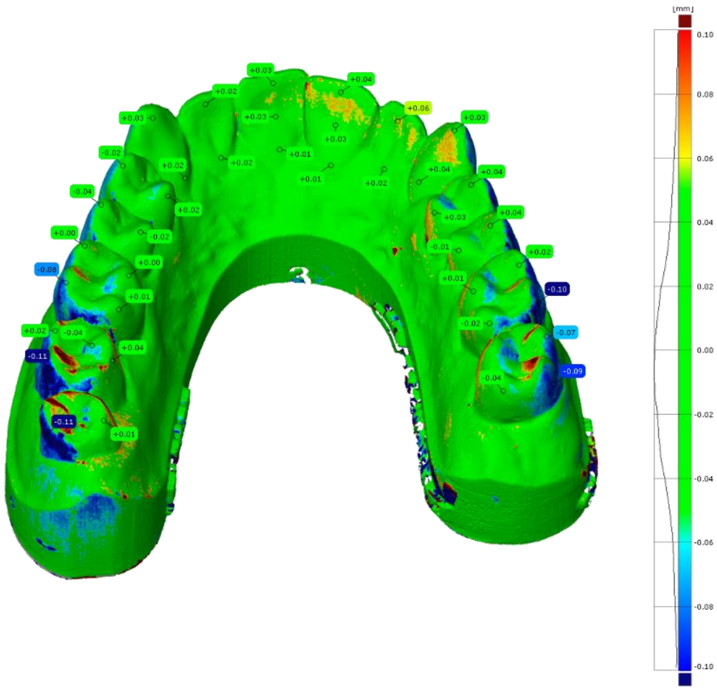
Ultracur3D® DM 2505 is within tolerance +/- 50µm (solid)

Demo model – solid upper jaw without connector: scan of 3D **printed model** vs. **original STL**.



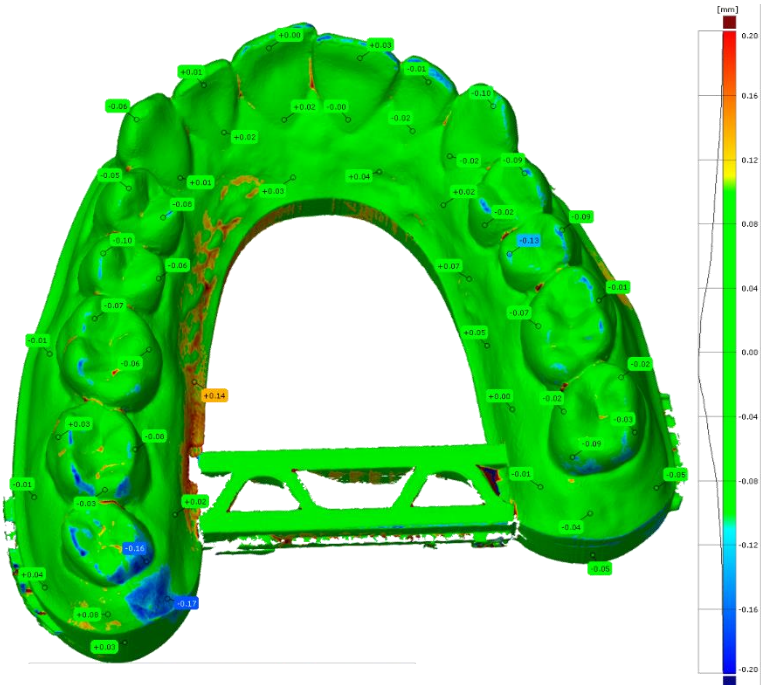
Ultracur3D® DM 2505 is within tolerance +/- 100µm (solid)

Demo model – solid upper jaw without connector: scan **after thermoforming** vs. scan of 3D **printed model**.



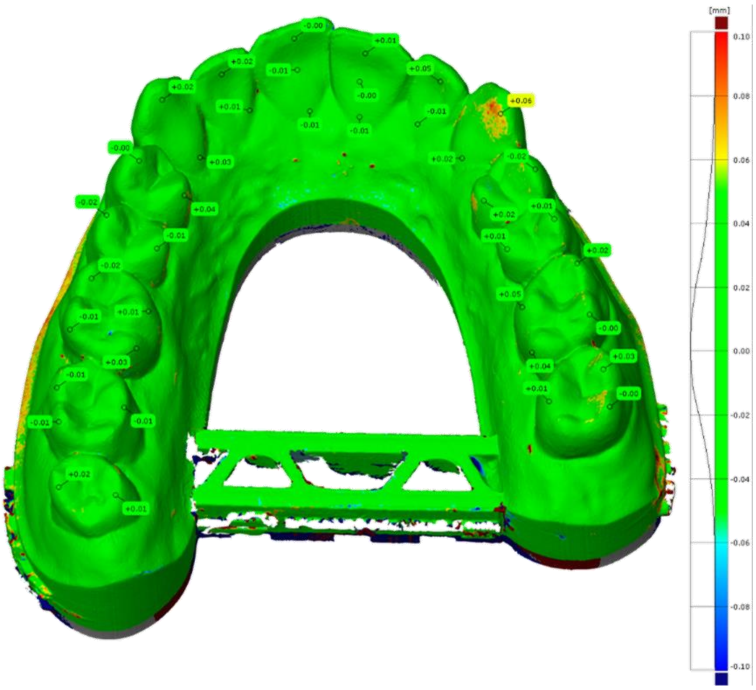
Ultracur3D® DM 2505 is within tolerance +/- 50µm (solid)

Demo model – hollowed upper jaw with connector: scan of 3D **printed model** vs. **original STL**.



Ultracur3D® DM 2505 is within tolerance +/- 100µm (hollow)

Demo model – hollowed upper jaw with connector: scan **after thermoforming** vs. scan of 3D **printed model**.



Ultracur3D® DM 2505 is within tolerance +/- 50µm (hollow)