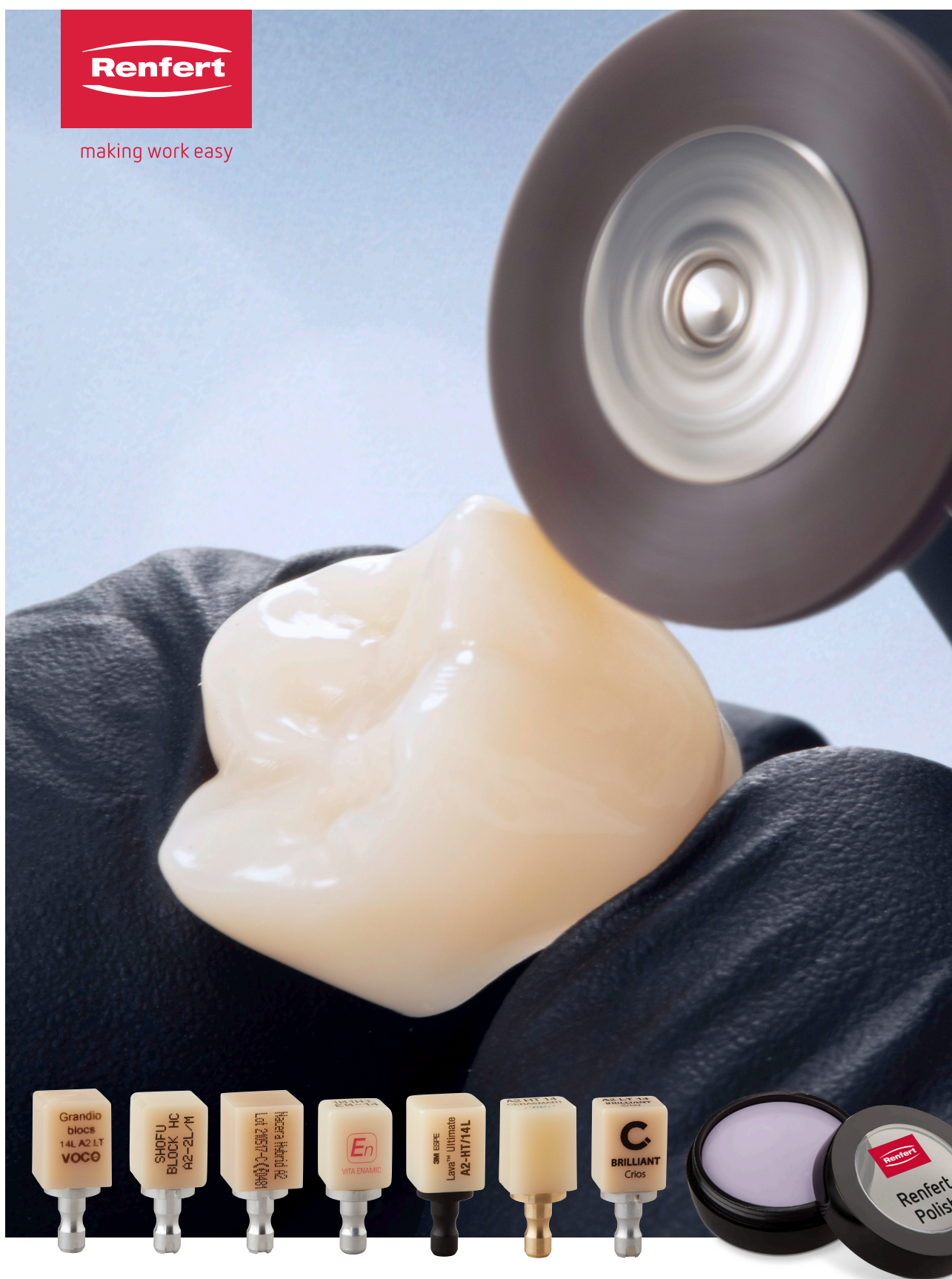


Renfert

making work easy



Renfert Polish hybrid materials

Date
12/2020

Technical and scientific documentation

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Introduction

Renfert is committed to delivering the most optimal solutions for the practical processing of various dental restorative materials. Especially for the final step of high-gloss polishing, Renfert supplies material-specific polishing pastes and instruments. The objective is to achieve fast, economical polishing along with optimal outcomes.

The polishing of dental hybrid materials

A technical and scientific analysis by Manfred Tauber, Master Dental Technician, Head of Dental Education at Renfert GmbH, and Dr. Frank Weber, Head of Chemistry, Renfert GmbH.

Increasingly, hybrids like CAD/CAM materials and filled veneer composites are used to fabricate indirect restorations. These dental composites unite the positive properties of two very distinct materials. This combination of ceramics and polymers exhibits a high load-bearing capacity with improved abrasion behavior while at the same time reducing brittleness and allowing easier processing of the restorations. However, polishing pushes conventional polishing agents to their limits because each of these two materials also has distinct requirements. Another complicating factor is the uneven material ratio – high ceramic, low composite content – which also varies from supplier to supplier. These are the



Fig. 1
The use of hybrid materials
in the fabrication of indirect
restorations

reasons why much more preparation and polishing work was previously required to achieve a satisfactory gloss level - albeit with limited results.

Renfert Polish hybrid materials comprise a specialized diamond polishing paste which does precise justice to the unique needs of these hybrid materials. The paste is designed to account for both the complex wetting behavior as well as the different degrees of hardness of the two material proportions.



Fig. 2
Renfert Polish hybrid materials – special polishing paste for polishing hybrid materials

Why is it so important to polish the surface to a high gloss?

In addition to aesthetic aspects, various authors [1] have demonstrated that the roughness of a surface correlates with the gloss within the high gloss range. On the other hand, the surface roughness has a critical mechanical impact on the antagonist and affects the growth of plaque. That means that achieving a consistently long-lasting high gloss is thus the most viable indicator of low roughness and, in turn, reflective of high-quality work. For that reason, Renfert develops, investigates and compares internally as well as through an external authoritative institute the roughness and level of gloss as defined by the gloss units (GU) of the various materials. This is the only way to achieve the optimal outcomes, with consistently smooth surfaces even upon closer inspection.

Lubrication with oils and the application of soft waxes can be used to easily imitate a visual high gloss on the materials, creating a short-term appearance, but that cannot be the objective. Particularly when using veneer composites and modern hybrid materials with composite content, the objective must be to reduce the plaque affinity as effectively as possible in order to extend the lifetime of the restorations.

The following presents the comparative studies of GU and topographic investigations of the surface roughness measurements of CAD/CAM-produced hybrid materials.

Comparison of various polishing pastes on different hybrid materials

Comparative examination of "Renfert Polish hybrid materials" on different hybrid materials versus the polishing pastes and polishing tools of the competitors.

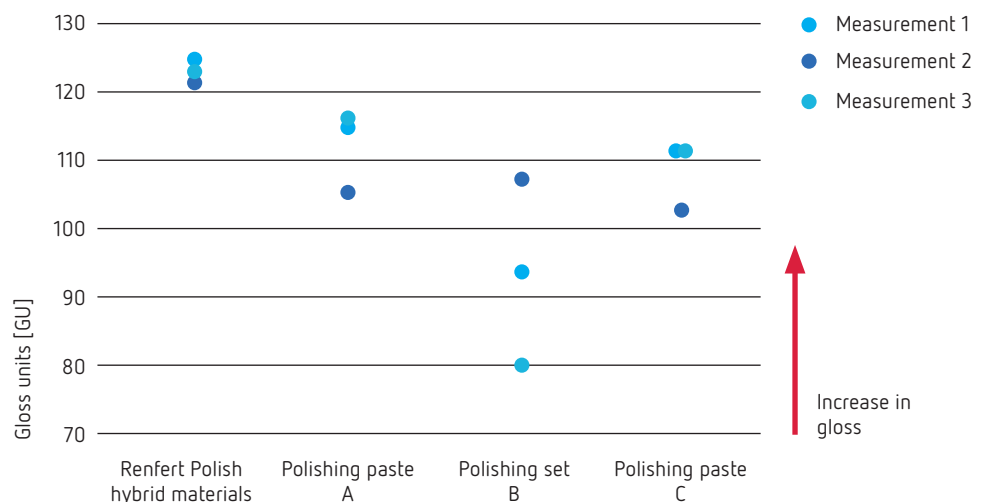
Description of the investigation and measured data (Development Department, Renfert GmbH)

For this investigation, at least three uniformly shaped test specimens each produced from the respective CAD/CAM block were pre-polished and then polished to high gloss according to the operating instructions under the same conditions. Subsequently, the test specimens were measured with a Minolta CM2500d operating on the basis of an Ulbricht ball. In particular, the 20° angle required for high-gloss measurement is not only maintained but sharpened to 10° and the measured data determined in gloss units (GU).

In the investigations with VITA ENAMIC®, the highest gloss units (GU) > 120 with the lowest spread of values was achieved with the "Renfert Polish hybrid materials" polishing paste developed by Renfert. This not only shows that excellent results can be achieved, but also that they are more reproducible than with comparator polishing sets or polishing pastes.

Diagram 1

Graph view of the results/
measured data and their
spread.
Representative examples of
the investigations.



Topographic investigation of polished material surfaces

Description of the topographic investigation and measured data of polished material surfaces (Felix Spalthoff FRT GmbH)

Three surface measurements respectively were conducted for each of the 7 hybrid materials on a non-polished sample and a sample polished to a high gloss with "Renfert Polish hybrid materials". As examples, the measured data of three hybrid materials with very disparate surface structures are presented. The following examples show a measurement before and after polishing. The investi-

FRT

gations were carried out using a MicroProf® with a CFM confocal microscopic sensor and a 50x objective at a measuring field size of 375 x 278 µm². All measurements were used to analyze the surface texture according to DIN EN ISO 25178.



Fig. 3
MicroProf® surface measuring tools by Felix Spalthoff, FRT GmbH

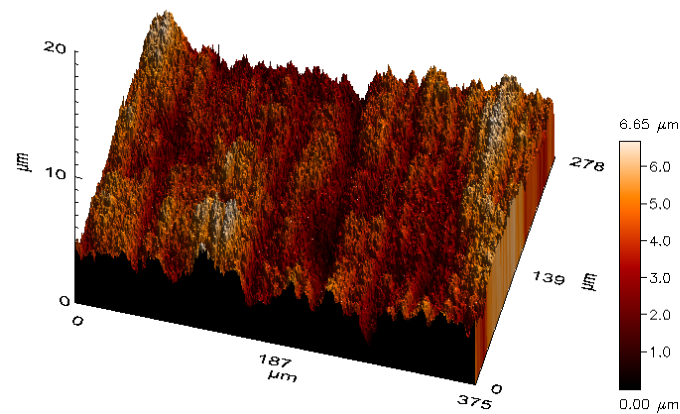
Results of VITA ENAMIC® before and after polishing

A long list of parameters were evaluated to investigate the surface roughness. Standard deviation (SD) is mostly commonly used measurand to describe error from the mean.

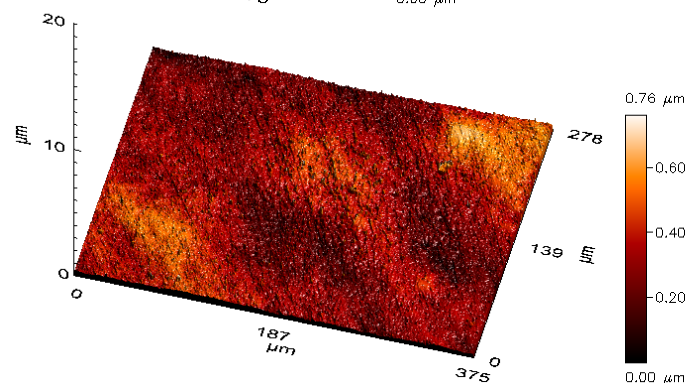
VITA ENAMIC®	Before	After
Sa [µm]	0.30	0.02

Even more striking is the three-dimensional plotting of the measurement results. Please note the markedly magnified scale (color) representing the polished case. The scaling of the heights/depths (z-axis) is the same, thereby ensuring a direct comparison of before and after polishing. The general processing tracks (see 3D test view 1), could be reduced to a minimum by polishing (see 3D test view 2).

3D test view 1
Surface of VITA ENAMIC® before polishing [supplied by: FRT GmbH]



3D test view 2
Surface of VITA ENAMIC® after polishing with Renfert Polish hybrid materials [supplied by: FRT GmbH]



Suitability for other hybrid materials

Other widely used materials were polished and measured to establish whether the results can also be transferred to other hybrid materials. Only two representatives are shown here as examples. Overall, it was shown that a sustained high gloss with a very low degree of roughness can be easily achieved efficiently and with little initial training on the part of the user. In conclusion, the "Renfert Polish hybrid materials" closes the gap between polishing pastes for purely ceramic materials "Renfert Polish LiSi₂", "Renfert Polish ZrO₂", "Renfert Polish all-in-one" as well as "Opal L" for pure resins.

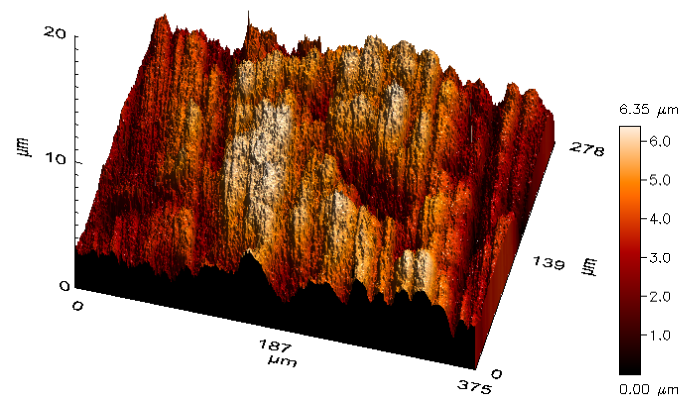
Results on GC CERASMART

For direct comparison, refer to the SD values.

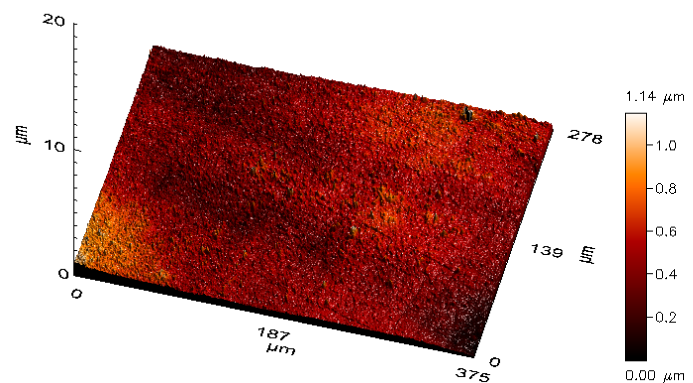
GC CERASMART	Before	After
Sa [μm]	0.37	0.04

And in turn, even more striking is the three-dimensional plotting of the results/ measured data. The scaling of the heights/depths (z-axis) is the same, thereby ensuring a direct comparison of before and after polishing. Polishing reduced the processing tracks and one marked defect (see 3D test view 3) to a minimum (see 3D test view 4).

3D test view 3
Surface of
GC CERASMART before
polishing
[supplied by: FRT GmbH]



3D test view 4
Surface of
GC CERASMART® after
polishing with Renfert
Polish hybrid materials
[supplied by: FRT GmbH]



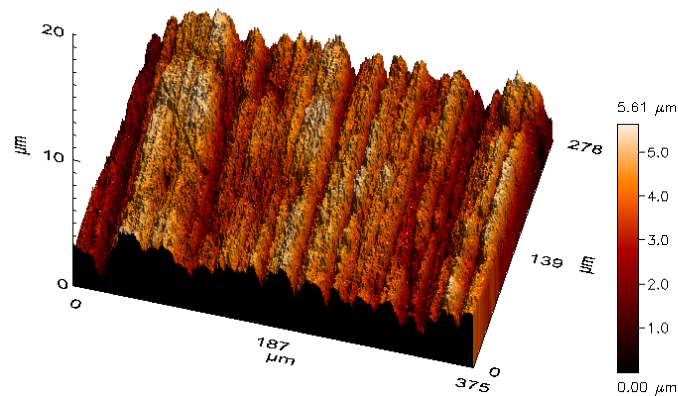
Results on 3M™ Lava™ Ultimate before and after polishing

For direct comparison, refer to the SD values.

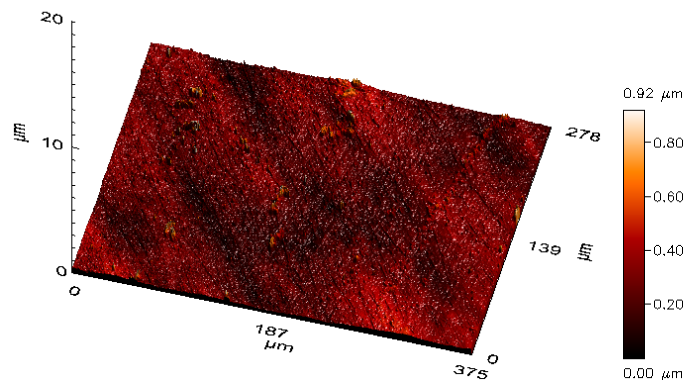
3M™ Lava™ Ultimate	Before	After
Sa [μm]	0.29	0.03

Here as well, note the three-dimensional plotting of the results/measured data. With same scaling of heights/depths (z-axis) and therefore directly comparable. Polishing reduced the parallel processing tracks (see 3D test view 5) to a minimum (see 3D test view 6).

3D test view 5
Surface of
3M™ Lava™ Ultimate
before polishing [supplied
by: FRT GmbH]



3D test view 6
Surface of
3M™ Lava™ Ultimate
after polishing with Renfert
Polish hybrid materials
[supplied by: FRT GmbH]



References

VITA ENAMIC® is a registered trademark of VITA ZAHNFABRIK H. RAUTER GMBH & CO. KG

Bibliography

[1] D.J. Donnermeyer, "Vergleich zweier Verfahren zur Messung der Oberflächeneigenschaften nach Zahnpasta-Anwendung [Comparison of two methods for measuring surface properties after toothpaste application]," Doctoral Thesis, University of Münster (WWU Münster), 2015