Looking back on ten years of clinical history, Lava™ Zirconia has proven its clinical reliability in more than 10 studies. In sum, over 1500 Lava™ crown and bridge restorations were placed with follow-up times of up to 7 years. From thinnest coping anterior crowns to posterior bridges – Lava™ Zirconia frameworks showed an excellent success rate.

Lava Zirconia is now released to be used in direct occlusal contact – either covered with a thin glaze layer or simply polished. These Lava All-Zirconia monolithic restorations give the clinician a biocompatible, durable and tooth-colored alternative to metal restorations for cases with limited inter-occlusal space and for patients with bruxism.

Lava Zirconia exposed to the oral environment is not totally new. It is already successfully used in restorations with unveneered crown margins, for primary crowns and for the Zirconia build-up for two-piece abutments. Lava Zirconia is well known for its excellent gingival tissue response and its lack of water solubility. However, the direct occlusal contact between the antagonist and Lava Zirconia raises new questions: What happens to Lava Zirconia under occlusal wear conditions? What happens to the antagonist tooth when in occlusal contact with Lava Zirconia?

Wear properties of Lava™ All-Zirconia

One might intuitively assess the abrasive properties of a material with its hardness. However, abrasiveness is mainly determined by the smoothness of a material. A smooth material will not lead to excessive antagonist abrasion because there will be little friction by mechanical interlocking between the two wear bodies.

Because surface smoothness is the key factor, Lava All-Zirconia monolithic restorations must be glazed or polished. The high luster polishability of Lava™ Zirconia using standard ceramic polishing techniques is something Lava users have already experienced for years when working with unveneered crown margins, primary crowns and abutments.

But what will happen to the antagonist?

And what about long-term behavior? Will Lava™ All-Zirconia stay smooth over time during clinical service?

To answer these questions, wear tests have been conducted comparing Lava™ Zirconia to state-of-the-art prosthodontic materials. Human enamel and the enamel model substance Steatite were used as the antagonists. It is important to note that the findings presented here are only valid for Lava™ Zirconia. Zirconia materials are not alike – especially with respect to complex properties like phase transformation and wear.

Wear behavior of Lava™ All-Zirconia on enamel in comparison to state-of-the-art materials

The purpose of this study was to measure the three-body in vitro enamel wear of several ceramic systems compared to enamel and gold controls. Polished specimen were exposed to the OHSU 3-body Oral Wear Simulator which produces both abrasion and attrition with 50,000 cycles in an abrasive medium.

Polished Lava™ Zirconia was tested equivalent to gold as a low wear antagonist fixed prosthodontic material and exhibits comparable wear behavior to bovine enamel.

Wear behavior of aged Lava™ All-Zirconia

The wear behavior of different Lava All-Zirconia surfaces on Steatite was compared in the pin-on-disk apparatus ABREX against 6 mm Steatite balls as antagonists (5 N load, and 5000 cycles, in water) to a present state-of-the-art veneering material. Steatite has a similar wear behavior to enamel and allows reproducible test results due to its consistent properties.

In addition to glazed and polished samples, autoclaved Lava™ All-Zirconia was investigated in order to see if superficial phase transformation of aged Zirconia shows a different wear behavior at the antagonist.
As a result from this study, the material Lava™ Zirconia itself reveals no wear at all. Polished, glazed and aged Lava Zirconia samples demonstrate even less wear at the antagonist than present state-of-the-art veneered ceramic surfaces. There was no significant difference between aged and polished samples.

Wear behavior of Lava™ All-Zirconia at high loads

Lava All-Zirconia monolithic restorations are especially dedicated for challenging clinical cases, e.g. in bruxers where high chewing forces occur. Therefore, 3M ESPE has tested the wear behavior of Lava All-Zirconia at high loads.

The Steatite sphere antagonist was moved in water across a material plate at a constant load of 35 N for 8640 cycles.

Polished Lava™ All-Zirconia exhibits less Steatite antagonist wear than lithium disilicate (IPS e.max® CAD). The differences in antagonist wear occur because Lava All-Zirconia surface did not roughen when abraded at high loads. The surface roughening of lithium disilicate becomes more obvious when looking at SEM pictures of the samples before and after wear testing.

The roughness values confirm this observation as they increase for lithium disilicate when used at high loads. Lava™ All-Zirconia stays at the same smooth level and even demonstrates smoothening at very high loads.

Bottom Line

Several In vitro-test results demonstrated that Lava™ All-Zirconia has antagonist preserving wear properties and is not abraded or roughened under occlusal load in water. Based on the excellent clinical performance documented for Lava™ Zirconia, 3M ESPE grants a 15 years limited warranty on Lava-Zirconia frameworks and Lava All-Zirconia monolithic restorations*.

* If fabricated by an Authorized Lava™ Milling Center on Lava™ Equipment in strict compliance with approved indications and instructions for use for Lava™ Crowns and Bridges. Only approved indications for Lava™ Zirconia are covered and the warranty does not cover any breakage resulting from accidents or misuse. Additional costs such as the cost of preparation and veneering are also not covered.

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7 J. GEIS-GERSTORFER, and C. SCHILLE. Influence of Surface Treatment on Wear of Solid Zirconia (LAVA), J Dent Res 90 (Spec Iss A): #145873, 2011
8 J. GEIS-GERSTORFER, C. SCHILLE. Investigations on Two-body Frictional Wear of Dental Ceramics with ABREX. J Dent Res 88 (Spec Iss A): #29723, 2009

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IPS e.max® CAD initial
Rₐ = 0.04 μm

IPS e.max® CAD after wear test
Rₐ = 0.18 μm

Lava™ Zirconia Initial
Rₐ = 0.03 μm

Lava™ Zirconia after wear test
Rₐ = 0.02 μm

Bottom Line

Several In vitro-test results demonstrated that Lava™ All-Zirconia has antagonist preserving wear properties and is not abraded or roughened under occlusal load in water. Based on the excellent clinical performance documented for Lava™ Zirconia, 3M ESPE grants a 15 years limited warranty on Lava-Zirconia frameworks and Lava All-Zirconia monolithic restorations*.