

EsperTM

Scientific Facts

Wear properties of 3MTM ESPETM LavaTM All-Zirconia Restorations

LavaTM All-Zirconia restorations

Over the last 10 years LavaTM Frame Zirconia has proven its reliability in more than 10 clinical studies. In sum, over 1500 veneered crown and bridge restorations were placed with follow-up times of up to 7 years. From thinnest coping anterior crowns¹ to posterior bridges² – LavaTM Frame Zirconia frameworks showed an excellent success rate.

Besides veneered LavaTM Zirconia restorations are also released to be used covered with a thin glaze layer only or simply polished in direct occlusal contact. These LavaTM All-Zirconia restorations give the clinician a biocompatible, tooth colored and highly durable alternative to metal restorations for cases with limited inter-occlusal space and for patients with bruxism.

LavaTM Zirconia is already used with direct exposure to the oral environment at unveneered crown margins, for primary crowns and for zirconia build-ups for two-piece abutments. LavaTM 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 zirconia raises new questions:

Are LavaTM All-Zirconia restorations antagonist friendly?

What needs to be considered in treatment planning?

How can I adjust and polish LavaTM All-Zirconia restorations?

Enamel wear of LavaTM All-Zirconia

Zirconia is a hard material. One might intuitively derive abrasiveness from hardness. However, abrasiveness is mainly determined by material smoothness.³ A smooth surface will not lead to excessive antagonist abrasion because there will be little mechanical interlocking between the two wear bodies.

The high luster polishability of LavaTM Zirconia is well known e. g. from unveneered crown margins and primary crowns. Adjustments can be performed with a red ring (30 µm grain) finishing diamond bur with water cooling. High luster polish is achieved using standard diamond loaded 3-step ceramic polishers.

Polished LavaTM Zirconia was found less abrasive to enamel compared to veneering porcelain and a pressed glass ceramic in the OHSU 3-body Oral Wear Simulator (Fig. 1).⁴

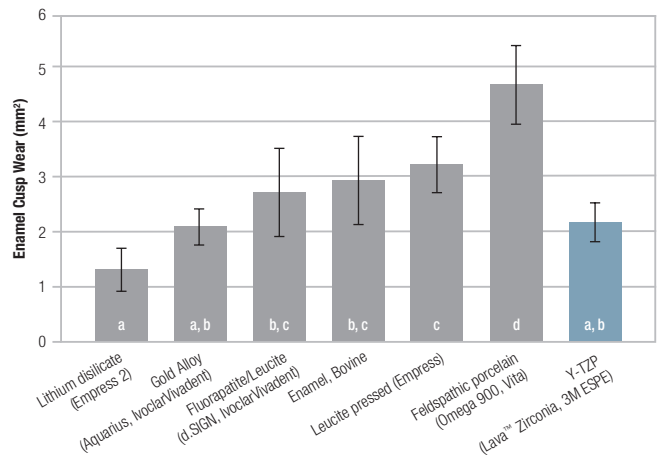


Fig. 1: Mean human enamel cusp wear against polished material in a abrasive medium (OHSU 3-body Oral Wear Simulator).

LavaTM Zirconia exhibits excellent polishability – and smooth LavaTM Zirconia restorations show low enamel abrasion. But what will happen long-term? Will LavaTM Zirconia restorations stay smooth over time?

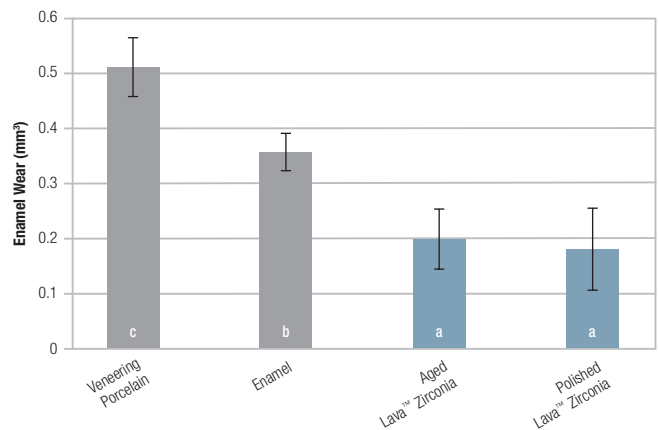


Fig. 2: Volumetric human enamel wear to LavaTM Zirconia (polished or polished and aged by autoclaving for 5 h at 135 °C, 2 bars), human incisor enamel and a veneering porcelain (Modified Alabama wear testing device).

To investigate this question the enamel wear behavior of LavaTM Zirconia material after accelerated aging was investigated at the University of Alabama at Birmingham (Fig. 2): “Aged zirconia had similar roughness and produced similar wear of opposing enamel as polished zirconia. Both zirconia groups produced less enamel wear than the veneering porcelain or natural enamel.”⁵

3M™ ESPE™ Lava™ Plus High Translucency Zirconia is the latest Lava™ Zirconia material. Lava™ Plus is a complete zirconia system that offers improved translucency and enhanced shading options ideal for monolithic restorations. Lava™ Plus Zirconia shows equivalent wear behavior to Lava™ Frame Zirconia: Aging does not affect the smoothness and maintains antagonist friendliness of Lava™ Plus Zirconia (Fig. 3).^{6,7}

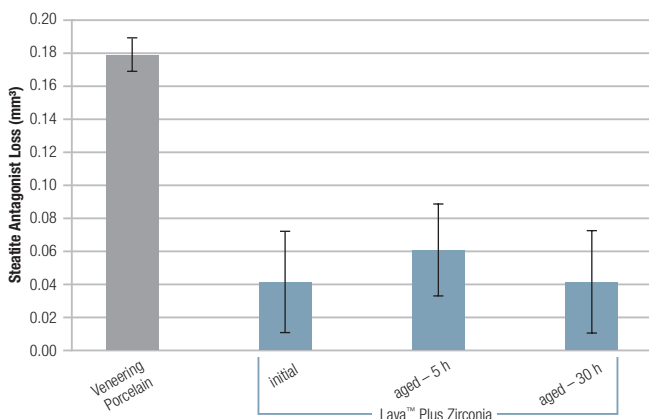


Fig. 3: Wear of enamel model substance Steatite® to Lava™ Plus High Translucency Zirconia (polished or polished and aged at 135 °C, 2 bars) and a veneering porcelain (Elcometer abrasion test device).⁶

3M™ ESPE™ Lava™ All-Zirconia Material Wear

Lava™ All-Zirconia restorations show no notable self abrasion – they will maintain their anatomic shape over time.^{6,7} Regarding self-abrasion Lava™ Zirconia restorations behave similar to non-precious metal restorations (Fig. 4).

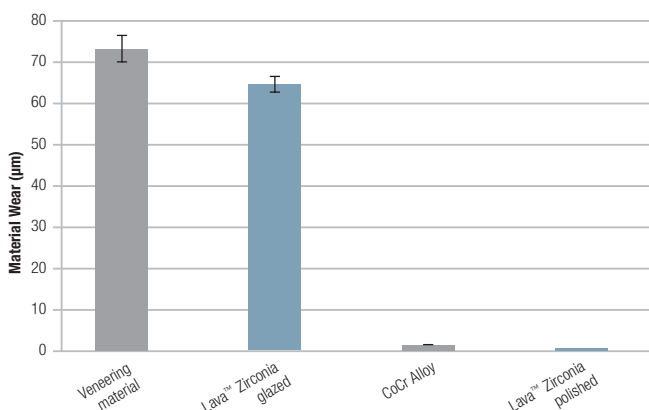


Fig. 4: Material wear of polished and glazed Lava™ Zirconia, a veneering material and non-precious metal CoCr alloy after abrasion in with a Steatite sphere at 25 N load (3M ESPE internal data, method published in⁹).

For both zirconia and non-precious metal the treatment plan has to consider the minimal self abrasion to maintain proper occlusion over time.

Bottom Line

Several *in-vitro-test* results demonstrated that Lava™ All-Zirconia restorations are more antagonist friendly than veneering porcelains when polished. The antagonist friendliness is preserved with aging.

Lava™ All-Zirconia restorations show no notable wear similar to non-precious metal – this needs to be considered in treatment planning.

Adjustments and polishing of Lava™ All-Zirconia restorations can be performed with standard diamond tools used for ceramics.

3M ESPE has expanded its 15 years limited warranty on frameworks to Lava™ All-Zirconia restorations.

¹ Schmitt J, Wichmann M, Holst S, Reich S. Restoring Severely Compromised Anterior Teeth with Zirconia Crowns and Feather-Edged Margin Preparations: A 3-Year Follow-up of a Prospective Clinical Trial. *Int J Prosthodont* 2010;23:107–109

² Crisp R, Burke T. Five-Year Evaluation of zirconia-based bridges in general practice: year-three results. *J Dent Res* 88 (Spec Iss A):3234, 2009

³ Oh W, DeLong R, Anusavice K. Factors affecting enamel and ceramic wear: A literature review. *The Journal of Prosthetic Dentistry* 2002;87:451-459

⁴ SORENSEN J, SULTAN E, SORENSEN P. Three-Body Wear of Enamel Against Full Crown Ceramic. *J Dent Res* 90 (Spec Iss A):1652, 2011

⁵ JANYAVULA S, LAWSON N, CAKIRD, BECK P, RAMP L, BURGESS J. Wear of enamel opposing aged zirconia. *J Dent Res* 91 (Spec Iss A): 418, 2012

⁶ Dittmann R, Urban M, Schechner G, Hauptmann H, Mecher E. Wear behaviour of a new zirconia after hydrothermal accelerated aging. *J Dent Res* 91 (Spec Iss A): 1317, 2012

⁷ Dittmann R, Urban M, Braun P, Schmalz A, Theelke B. Wear behaviour of zirconia after hydrothermal accelerated aging. *J Dent Res* 90 (Spec Iss B): 307, 2011

⁸ R.W Wassell, J.E McCabe, and A.WG. Walls. A Two-body Frictional Wear Test. *J Dent Res* 73(9):1546-53, September, 1994

⁹ T. KURETZKY, M. URBAN, R. DITTMANN, R. PEEZ, and E. MECHER. Wear Behaviour of Zirconia Compared to State-of-the-art Ceramics. *J Dent Res* 90 (Spec Iss A): 3055, 2011



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