

Lava™ Crowns & Bridges

Sandblasting or Rocatec™ Treatment of Lava™ Zirconia

Is it necessary or recommended to sandblast zirconia?

The main concern is the question whether sandblasting impacts the strength and long-term stability of the material. As sandblasting and treatment with the 3M™ ESPE™ Rocatec™ System are similar processes (bombardment of the material with particles (sandblasting), or coated particles (Rocatec™ treatment)), 3M ESPE has tested both procedures with its own Lava™ zirconia and found no reduction in strength while using the recommended $\leq 50\mu\text{m}$ sand material and/or Rocatec Soft bonding treatment. Cojet™ Adhesive System also can be used for chairside sandblasting.

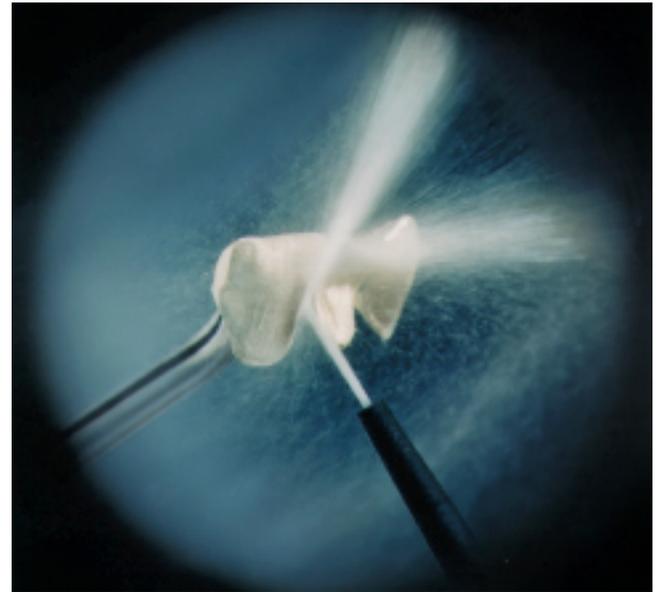
Why sandblast a material?

When sandblasting a material it is bombarded by particles of different grain sizes. The aim of sandblasting is to increase the surface area, obtain higher surface roughness and/or to purify the material.

The cement can optimally wet the larger interface resulting in better mechanical retention of the restoration. Often, the outer surface of the restoration framework has been sandblasted for the same reason to optimize the interface to the veneering. However, in the case of CAD/CAM milled Lava zirconia restorations, the sandblasting of the outer surface is not necessary or recommended, because of the roughness of the restoration, as milled, and the good wetting behavior of the Lava™ Ceram veneering ceramic. In addition, transformation processes may occur on the outer surface resulting in a change in the Co-efficient of Thermal Expansion (CTE) of the material, which is not desirable even though this phenomenon has not been found to be critical for Lava zirconia.

Why Rocatec/Cojet™ treatment (silicatization and silanization)?

For chemical bonding with an adhesive cement, glass ceramic materials are etched by hydrofluoric acid (HF) in order to increase the surface and are subsequently silanized to get a chemical bonding between the inorganic ceramic

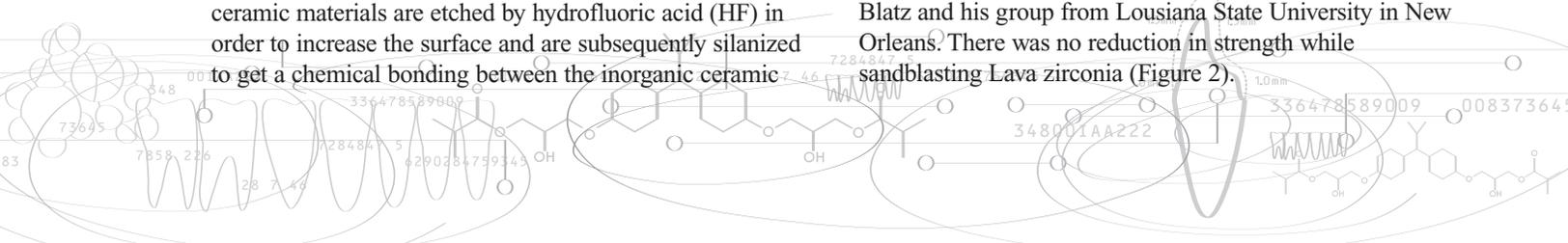


material and the organic resin material of the cement. In the case of zirconia, acid etching is not possible due to the special chemistry of the zirconia; furthermore, zirconia has no specific groups to bond to the silanization agent (e.g. 3M™ ESPE™ Sil). Therefore, the zirconia has to be treated with Rocatec Soft bonding material. Through this treatment, by tribochemical reaction, the surface of the zirconia is coated with small particles of silicium oxide. These can bind to the silanization agent (3M™ ESPE™ Sil) and establish a chemical bonding to the adhesive resin cement.

Do sandblasting or Rocatec™ treatments have any impact on the strength of Lava zirconia?

Sandblasting

Dr. G. Fleming from the University of Birmingham analyzed the effect of sandblasting with different grain sizes on the strength of the Lava zirconia material. He found no significant reduction by sandblasting with particle sizes of $\leq 50\mu\text{m}$ (Fig. 1). This was further confirmed by Dr. M. Blatz and his group from Louisiana State University in New Orleans. There was no reduction in strength while sandblasting Lava zirconia (Figure 2).



INSIGHT

Sandblasting of Zirconia

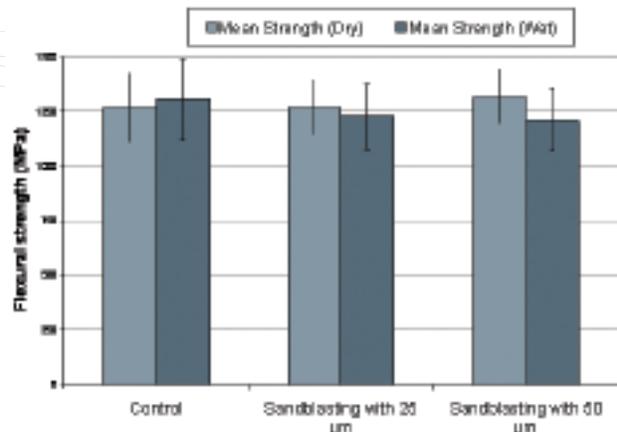


Figure 1: No strength reduction after sandblasting of Lava zirconia with different particle sizes; Dr. G.J.P. Fleming et al. (2005)

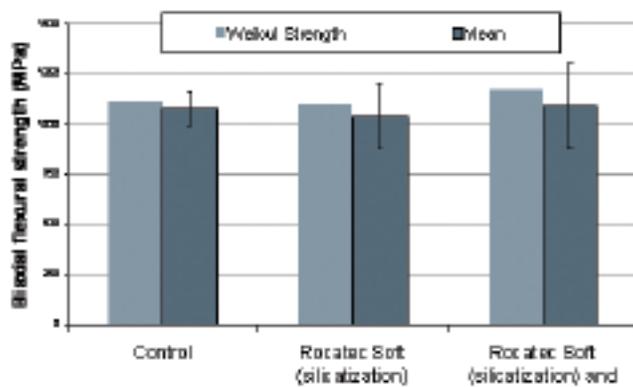


Figure 3: No strength reduction after Rocatec Soft treatment (30µm) of Lava zirconia initially and after cyclic loading and thermocycling (50N, 1.2 Million cycles).

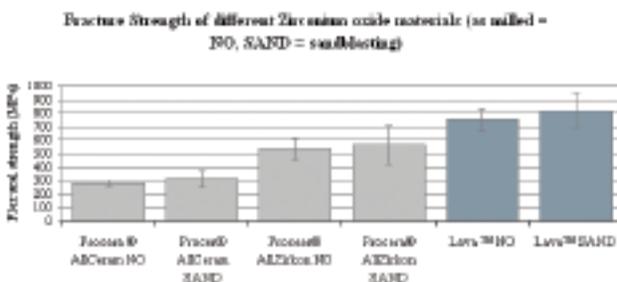


Figure 2: No strength reduction after sandblasting of different ceramic materials

Rocatec™ System

Silicatization with Rocatec™ Soft Bonding Material does not significantly decrease the strength of the material. Additionally, after artificial aging by cyclic loading and thermocycling, the strength of the Rocatec Soft-treated Lava™ zirconia is not affected (Fig. 3).

Research Summary

There is no strength reduction in Lava zirconia as a result of either sandblasting or Rocatec/Cojet treatment of the material. In order to optimize the bonding to the cement, Lava zirconia could be sandblasted and/or treated with the Rocatec™ Soft or Cojet treatment. The sandblasting of the outer surface is, however, not necessary.

Not all zirconia is created equal!

There are various Y-TZP-zirconium oxide materials on the market, however they are not all the same. They all consist of zirconium oxide with 3 mol-% yttrium oxide along with stabilizing agents. However, the materials are not equal because the production processes, as well as the initial raw materials, differ. Different grain sizes, grain size distributions and the distribution and concentration of the stabilizing agents can influence the mechanical and optical characteristics of the ceramic. Additionally, the homogeneity of the zirconium oxide, hence the quality, highly affects the performance of the material. The benefits of Lava™ zirconia provide a unique combination of properties and esthetics like no other zirconia material on the market today.

REFERENCES:

- [1] G.J.P. Fleming, A.R. Curtis and P.M. Marquis (2005) Alumina abrasion and grinding effects on yttria-stabilized zirconia ceramic, IADR Baltimore, #1339
- [2] A. R. Curtis, A. J. Wright and G. J.P. Fleming, The influence of surface modification techniques on the bi-axial flexure strength and reliability of a Y-TZP dental ceramic, 2005, submitted
- [3] J.L. Chapman, D.A. Bulot, A. Sadan and M.B. Blatz (2005) Flexural strength of High-Strength Ceramics after Sandblasting, IADR Baltimore, #1757
- [4] A. Behrens, H. Nessler and H. Hauptmann (2005) Fracture Strength of Sandblasted and Silicatized Coloured and Non-Coloured Zirconia, IADR Baltimore, #0558



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