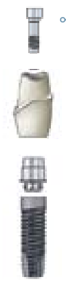
Espertise™ Scientific Facts

Lava™ Zirconia for Implant Abutments

The increasing demand for highly esthetic dental restorations has led to exciting innovations in recent years. In implant dentistry, improvements in digital technologies have allowed laboratories and their dentist partners to create custom designed all-ceramic implant abutments. Now, this indication is available using Lava zirconia and the Lava™ Digital Platform, enabling labs to deliver esthetic implant abutments with the excellent marginal fit, optimal strength, and translucency that the Lava brand is known for.



With the Lava™ Scan ST Design System, the lab is given complete control in designing the abutment. The process begins with scanning a custom wax-up with the Lava™ Scan ST Scanner, then milling, shading, and sintering the Lava zirconia—just as it is done for Lava™ Crowns and Bridges. The abutment head is then bonded to the titanium interface without creating torque pressure to the zirconia. This method provides compatibility with a wide variety of implant systems.

While this indication is relatively new for the Lava platform, testing data shows the system offers the strength to serve patients well. Using 3M™ ESPE™ RelyX™ Unicem Self-Adhesive Universal Resin Cement, researchers bonded sample implant abutments made from Lava zirconia to titanium interfaces, then subjected the samples to *in vitro* testing in flexural strength, dynamic fatigue, and pull strength. The resulting data demonstrates these restorations and their cemented bonds offer strength that labs and dentists can feel confident recommending.

Flexural Strength Test

The objective of the flexural strength test is to determine the maximum initial flexural force that will cause a failure in the implant abutment, and to ensure that the abutment is strong enough to withstand chewing forces in the mouth. Average maximum chewing forces *in vivo* for the typical adult male have been measured to be 550-600 N in the posterior region.[1,2,3]

fig. 1a Applying force at a 30° angle. 3M ESPE, 2008.

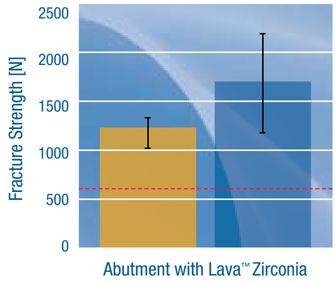


fig. 1b Flexural strength values for Lava™ Zirconia for Implant Abutments cemented on Camlog™ implant and interface. 3M ESPE, 2008.

Results: The implant abutments made from Lava zirconia withstood forces far exceeding those that occur *in vivo*, under both occlusal loading conditions and at a 30° angle.

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1 Schwenzer N., Zahn-, Mund- und Kieferheilkunde, Prothetik und Werkstoffkunde Band 3, Thieme Verlag 1982;
2 Baltzer A., Kaufmann-Jinoian V. Die Beurteilung von Kaukräften (2002) Quintessenz Zahntechnik 28, 9, 982-998;
3 Kappert, Knode, Schultheiß (1991) Festigkeitsverhalten der InCeram Keramik bei mechanischer und thermischer Wechsellast im Kunstspeichel. Dtsch Zahnärztl. Z. 46, 129

Dynamic Fatigue Test

This test simulates chewing in the mouth to estimate the long-term strength and stability of the abutment. Five million cycles are roughly equivalent to 10 years in the mouth. [4]

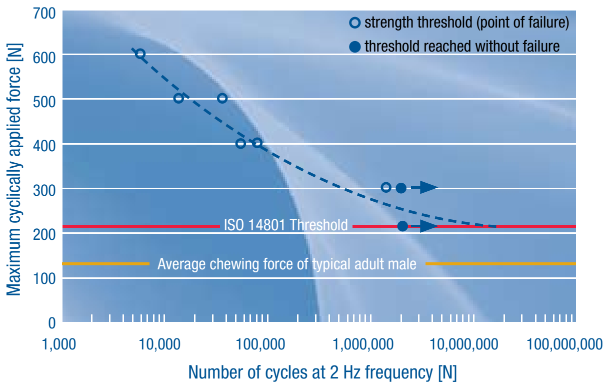

fig. 2a Dynamic fatigue test values for the implant abutment made from Lava™ Zirconia, Camlog™ implant and interface, per ISO 14801. 3M ESPE, 2008.

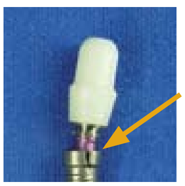

fig. 2b In dynamic fatigue testing, the titanium implant failed before the cemented interface between the Lava™ Zirconia and titanium, demonstrating the bond strength between Lava zirconia, RelyX™ Unicem Cement and the titanium abutment. 3M ESPE, 2008.

Results: After two million chewing cycles at a constant force of 200 N, 100% of tested samples remained intact. The titanium implant failed before the abutment made from Lava zirconia or abutment interface. The results demonstrate the Lava zirconia's ability to withstand pressure well in excess of the average chewing force of 130 N.

Pull Test

The pull test measures the force required to separate the zirconia abutment from the titanium interface, simulating forces that occur in the mouth by, for example, chewing sticky candy. A tensile force is applied to the implant abutment, and the level at which the cement fails is recorded. A sticky caramel solution used for testing had an average pull force of 80 Newtons, and the strongest measured pull force using this solution was 100 Newtons. The pull force of the strongest impression material identified was 80 N. (3M ESPE internal test)

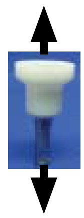

fig. 3a The implant abutment and interface are pulled at both ends to determine pull strength. 3M ESPE, 2008.

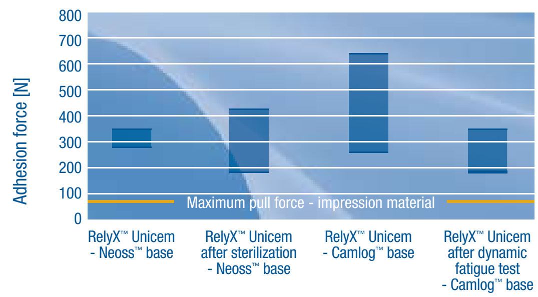

fig. 3b Adhesion of abutments made from Lava™ Zirconia cemented with RelyX™ Unicem Cement to titanium abutment bases. 3M ESPE, 2008.

Results: Implant abutments made from Lava zirconia adhered strongly to a variety of titanium bases, withstanding significant tensile forces. Additionally, the results were satisfactory even following sterilization and dynamic fatigue testing.

Study Conclusions

When subjected to compression forces and bending moments, the cemented abutments made from Lava zirconia performed in the mentioned test designs better than the titanium implant system, withstanding forces well beyond those that occur naturally. Additionally, the measured pull-off forces of cemented abutments made from Lava zirconia exceeded tensile forces that occur during chewing. Although further testing and evaluation must be completed, these initial results should give dentists and dental labs high confidence in the success rate of Lava zirconia for implant abutments.

4 Scortecci GM, Misch CE, Brenner KU. Implants and Restorative Dentistry. Taylor & Francis. Pg. 121-122.

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