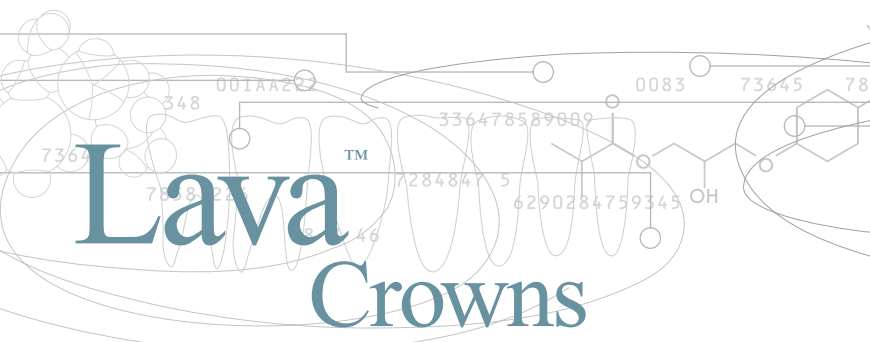


3M ESPE

3M™ ESPE™ Products
in the Focus of
International Science



Lava™
Crowns
and Bridges

In Vivo Clinical Studies,
In Vitro Research
Reviews 2000–2006

Lava™ Crowns and Bridges

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Lava™ Crowns and Bridges

Introduction

Dear Reader,

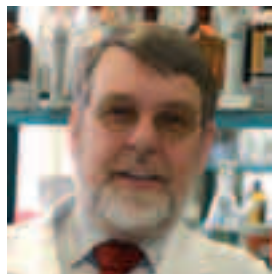
Introduced in 2002, the demand for Lava™ restorations continues to grow. Every year more dentists ask for Lava restorations from their dental lab. They trust Lava restorations because they've learned from experience what five years of clinical history have proven:

Lava restorations offer high strength performance, an outstanding marginal fit and excellent esthetics.

The outstanding marginal fit of a Lava restoration is made possible with the precision of the LavaSystem's CAD/CAM technology. Combined with excellent material properties this results in successful restorations. In addition to proven high strength performance, Lava materials also have a substructure shading system. By offering Lava substructures in eight colors, dental technicians can start with the natural dentin color. This means the translucency of the zirconia is maintained. In addition, the ceramist is given more room to stack the Lava™ Ceram overlay porcelain. Both of these factors ultimately provide outstanding esthetics.

Many renowned universities and scientific institutions have performed In Vitro and In Vivo studies showing the excellent mechanical and optical characteristics of Lava crowns and bridges. At this point, we want to thank and congratulate them for their excellent work. At 3M ESPE, we are committed to working with the scientific community in order to deliver high quality products.

In this booklet, we have summarized the research about Lava™ Crowns and Bridges. We encourage you to review these facts. However, as good as facts are, we believe the best way to learn more about Lava Crowns and Bridges is to put a Lava™ restoration to your own test.



Dr. Oswald Gasser

Enjoy reading *Expertise™*.

Yours sincerely,

Global Technical Director
3M ESPE AG
ESPE Platz
82229 Seefeld

Lava™ Crowns and Bridges

Official Ratings



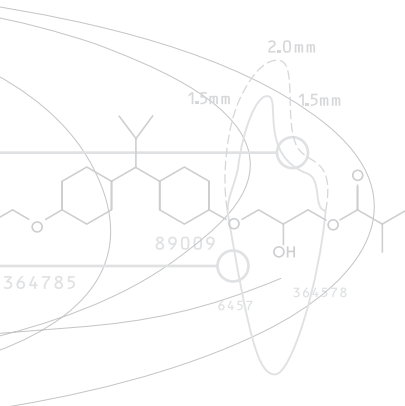
Lava™ was selected “Most Innovative Product” for 2005 by REALITY.



Excellent rating of THE DENTAL ADVISOR, Vol. 21, No. 10, December 2004

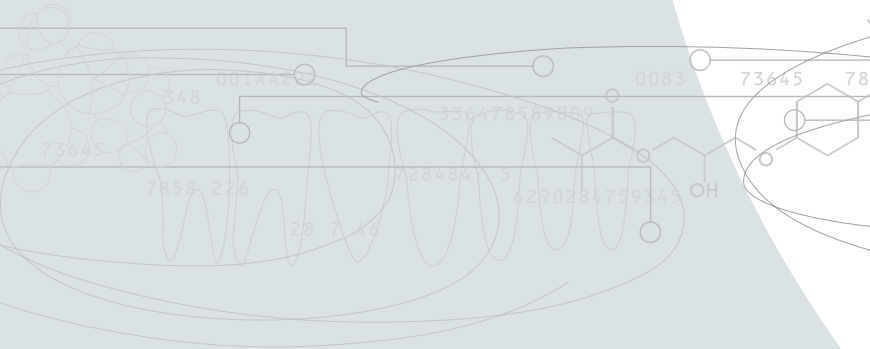
Consultants' Comments:

- “3M ESPE Lava allows me to provide my patient with strong, esthetic restorations.”
- “The marginal integrity is equivalent to that achieved with ceramic-metal restorations.”
- “As found with all restorations, esthetics is largely dependent on the laboratory fabricating the restorations.”



Clinical Results

1



Lava™ Crowns and Bridges

1.1 Clinical Studies

1 Five-year Clinical Performance

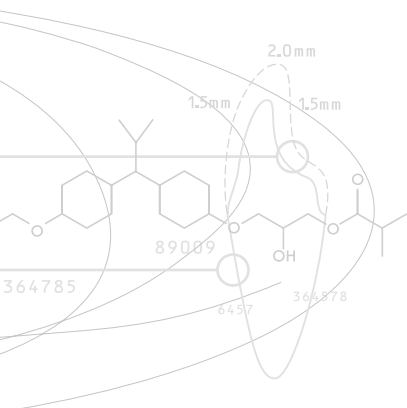
Clinical Long-term Behavior of Zirconia-based Bridges (LAVA): Five Years Results

Published at: 0312 PEF 2006

F.P. NOTHDURFT¹, P.R. ROUNTREE², and P.R. POSPIECH¹, ¹ Saarland University, Homburg/Saar, Germany, ² Private Practice, Munich, Germany

Aim of the Study: The aim of the study was to analyze the clinical performance of 3M™ ESPE™ Lava™ 3-unit posterior bridges after 5 years in situ.

Results of the Study: 68% of the restorations could be recalled after five years. All the restorations are still in situ. No changes in fit or secondary caries were observed. No total failures regarding the restoration's integrity happened. Slight chipping of the veneering material took place in single cases, but there was no need for retreatment. No allergic reactions and negative influences on the marginal gingiva could be observed. The remaining patients (32%) unfortunately moved to unknown places. One dropped out due to endodontic reasons.



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Lava™ Crowns and Bridges

1.1 Clinical Studies

Three-year Clinical Performance

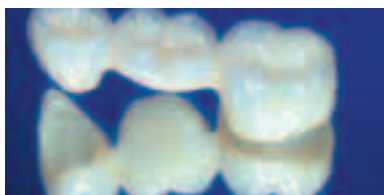
A Prospective Study on the Long-term Behavior of Zirconia-based Bridges (Lava): Results After Three Years in Service

Published at: 230 CED 2004

P. POSPIECH and F. NOTHDURFT, Dept. of Prosthetic Dentistry and Dental Materials Science, Saarland University, Homburg, Germany

Aim of the Study: This study evaluated the clinical performance of posterior 3M™ ESPE™ Lava™ bridges made from 3M ESPE Lava zirconium oxide and veneered with Lava™ Ceram.

Results of the Study: No total failures, no allergic reactions nor negative influences on the marginal gingiva could be observed. A very good clinical performance of Lava posterior bridges can be concluded after up to three years.



Three-unit posterior bridge made of Lava™ zirconium oxide.

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Lava™ Crowns and Bridges

1.1 Clinical Studies

1 Two-year Clinical Performance

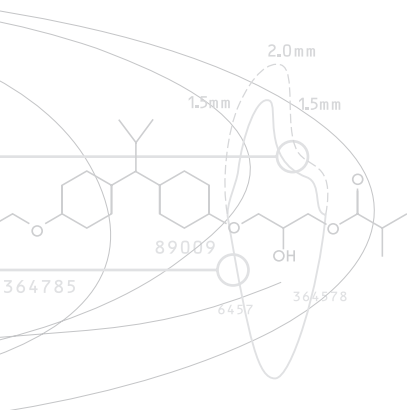
Clinical Evaluation of Zirconia-based All-ceramic Posterior Bridges: Two-year Results

Published at: 0817 IADR 2003

P.R. POSPIECH,¹ P.R. ROUNTREE² and F.P. NOTHDURFT,¹ ¹ Saarland University/ Homburg, Homburg/Saar, Germany, ² Ludwig-Maximilians-University, Munich, Germany

Aim of the Study: This study evaluated the clinical performance of posterior 3M™ ESPE™ Lava™ bridges made of zirconium oxide and veneered with Lava™ Ceram. The mean observation time was 16.8 months.

Results of the Study: No total failures, no allergic reactions or negative influences on the marginal gingiva could be observed. A very good performance of Lava posterior bridges can be concluded after two years.



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Lava™ Crowns and Bridges

1.1 Clinical Studies

One-year Clinical Performance

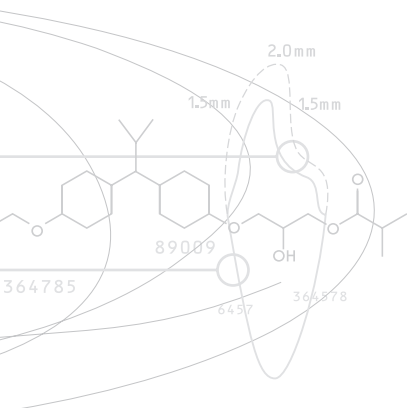
Clinical Longevity of CAD/CAM Generated Y-TZP Posterior Fixed Partial Dentures

Published at: 0270 AADR 2006

J.A. SORENSEN, R. LUSCH, and K. YOKOYAMA, Pacific Dental Institute, Portland, OR, USA

Aim of the Study: The aim of the study was to analyse the clinical performance of 3M™ ESPE™ Lava™ zirconium oxide 3- and 4-unit bridges.

Results of the Study: After a mean observation time of 19 months, Lava shows a success rate of 100%.



Lava™ Crowns and Bridges

1.1 Clinical Studies

1 One-year Clinical Performance

Clinical Efficacy of Y-TZP-based Posterior Fixed Partial Dentures

Published at: 0226 IADR 2005

A.J. RAIGRODSKI,¹ G.J. CHICHE,² N. POTIKET,² J.L. HOCHSTEDLER,² S.E. MOHAMED,² S. BILLIOT² and D. E. MERCANTE,² ¹ University of Washington, Seattle, USA, ² Louisiana State University, New Orleans, USA

Aim of the Study: The clinical performance of posterior 3-unit 3M™ ESPE™ Lava™ zirconium oxide bridges has been determined.

Results of the Study: After a mean observation time of one year, no failure of a 3M ESPE Lava zirconium oxide restoration was observed. All FPDs but one were rated as alpha in all measured parameters.



Fixed partial denture made of Lava™ zirconium oxide.

Lava™ Crowns and Bridges

1.2 Connector Dimensions

Clinical Relevance of Different Connector Dimensions

Clinical Connector Dimensions of CAD/CAM-produced All-ceramic FPDs

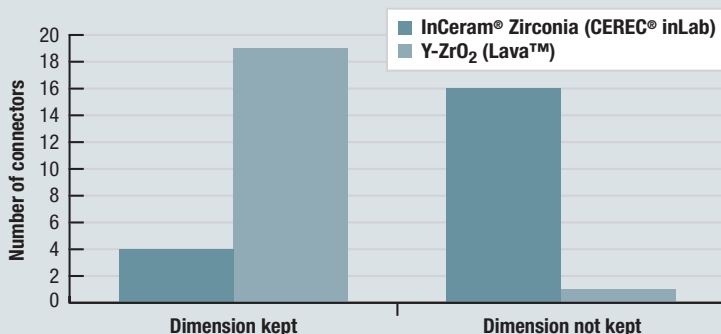
Published at: 1355 IADR 2003

S. REICH, University of Erlangen-Nuremberg, Germany

Aim of the Study: This study evaluated the clinical practicability of the connector dimensions of InCeram® Zirconia frameworks® (CEREC® inLab) and Lava™ zirconium oxide frameworks (3M™ ESPE™) for 3-unit bridges up to 30 mm length.

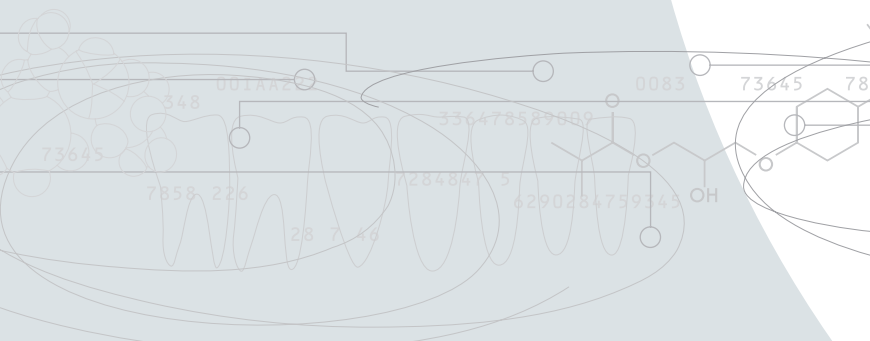
Results of the Study: In the Lava zirconium oxide (3M™ ESPE™) group 19 out of 20 connectors kept the recommended connector dimensions, whereas only 4 kept it in the InCeram Zirconia (CEREC inLab) group. Therefore, Lava™ zirconium oxide (3M™ ESPE™) promises a wider range of indications from a functional as well as an esthetic point of view.

Clinical Connector Dimensions



Text and graphics above refer to branded products offered by various companies.
For trademark information, please see the back page of this brochure.

Mechanical and Optical Characteristics



Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Initial Strength of ZrO₂ Specimens

2

Fractographic Analysis and Material Properties of a Dental Zirconia

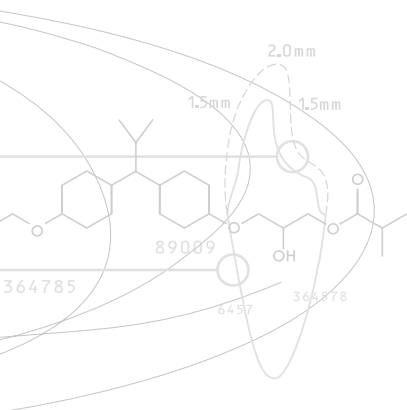
Published at: 0560 IADR 2005

J.B. QUINN,¹ D. CHENG,¹ R. RUSIN,² and D. SUTTOR,^{2, 1} American Dental Association Foundation, Gaithersburg, MD, USA, ² 3M ESPE Dental, St. Paul, MN, USA

Aim of the Study: The aim of the study was to determine the material properties of 3M™ ESPE™ Lava™ zirconium oxide.

Results of the Study: Lava zirconium oxide shows excellent material properties. The flexural strength as well as the toughness of Lava zirconium oxide was shown to be very high.

	4-point flexural test	Knoop hardness	E-modulus	Toughness
values	1066 ± 131 MPa	11.2 ± 0.2 GPa	216 ± 2 GPa	11.0 ± 0.4 MPa-m ^{1/2}



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Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Initial Strength of ZrO₂ Specimens

Material Properties of All-ceramic Zirconia Prostheses

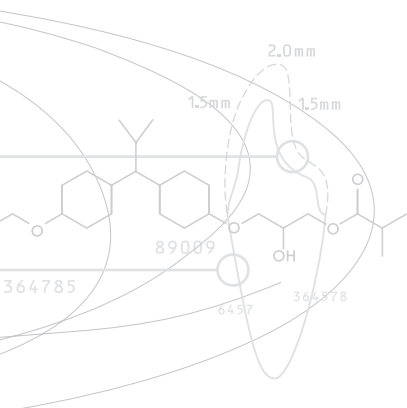
Published at: 2910 IADR 2000

H. HAUPTMANN, D. SUTTOR, S. FRANK and H. HOESCHELER, 3M ESPE AG,
82229 Seefeld, Germany

2

Aim of the Study: The 3M™ ESPE™ Lava™ zirconium oxide ceramic was evaluated with regard to all relevant dental ceramic properties, and a preliminary lifetime prediction was deduced.

Results of the Study: The Lava zirconium oxide material shows outstanding mechanical and optical properties for use as dental restoration material. Moreover, due to the positive lifetime prediction, the fabrication of posterior bridges with Lava zirconium oxide material is possible.



Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Initial Strength of ZrO₂ Specimens

2

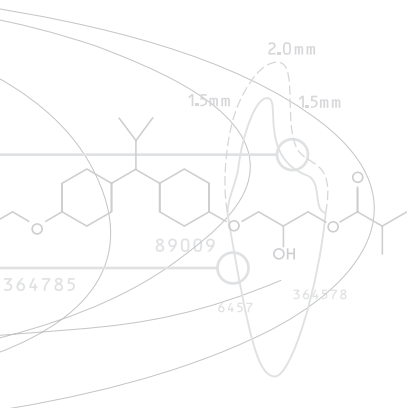
Intrinsic and Application Strengths of Strong Ceramic Core Materials

Published at: 1873 AADR 2006

M. CABRERA, Y. ZHANG, and V.P. THOMPSON, New York University, USA

Aim of the Study: The aim of the study was to determine the strength of different Zirconium oxide materials.

Results of the Study: 3M™ ESPE™ Lava™ zirconium oxide has a high strength as fired as well as with a polished surface. Moreover, zirconium oxide has a higher strength compared to aluminium oxide.



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Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Strength of Colored ZrO₂ Specimens

Flexure Strength of Yttria Partially Stabilized Colored/un-colored Zirconia

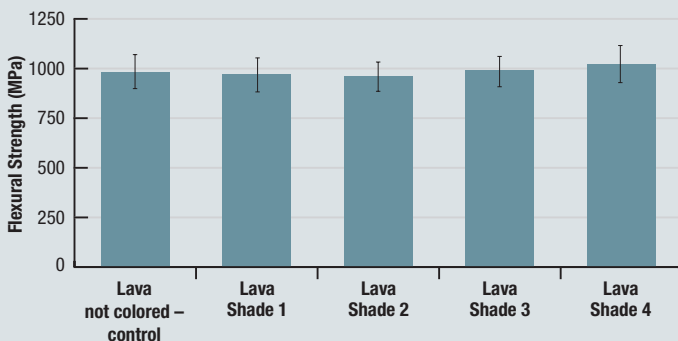
Published at: 1874 AADR 2006

S. FARSI, R. GIORDANO, and R. POBER, Boston University, MA, USA

Aim of the Study: The aim of the study was to show that coloring does not reduce the strength of zirconium oxide.

Results of the Study: There was no reduction in strength of 3M™ ESPE™ Lava™ zirconium oxide due to coloring.

Flexural Strength of colored Lava zirconium oxide



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Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Strength of Colored ZrO₂ Specimens

2

Fracture Strength of Colored vs. Uncolored Zirconia Specimens

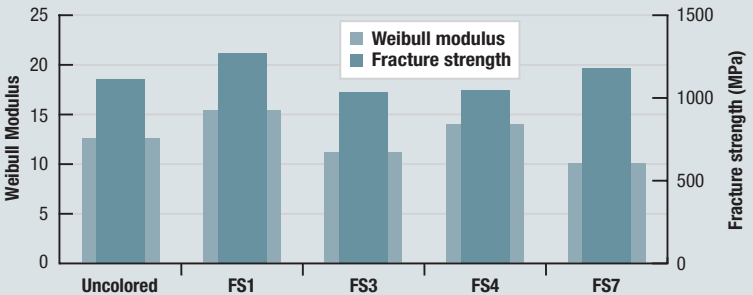
Published at: 0243 IADR 2004

A. BEHRENS, B. REUSCH and H. HAUPTMANN, 3M ESPE AG, Seefeld, Germany

Aim of the Study: The aim of this study was to show that the fracture strength of Y-TZP 3M™ ESPE™ Lava™ zirconium oxide is not affected by staining the material.

Results of the Study: There is no significant reduction of the fracture strength of Y-TZP Lava zirconium oxide by staining the material.

Fracture Strength of Colored vs. Uncolored Lava Zirconium Oxide



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Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Strength after Abrasion, Grinding or Silica-coating (Rocatec™/Cojet)

Alumina Abrasion and Grinding Effects on Yttria-stabilized Zirconia Ceramic

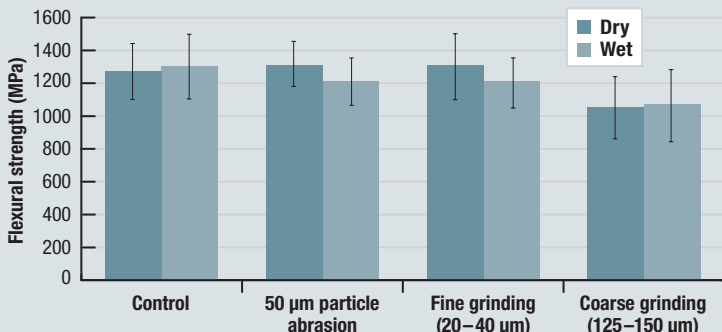
Published at: IADR 2005 Abstract 1339 I. Dent 2006, 39, 3, 195–206

G.J.P. FLEMING,¹ A.R. CURTIS¹ and P.M. MARQUIS,^{2,1} University of Birmingham, United Kingdom, ² The University of Birmingham, United Kingdom

Aim of the Study: The influence of sandblasting (alumina abrasion) or grinding on the strength of Lava™ zirconium oxide was analyzed.

Results of the Study: Pre-cementation and crown adjustment techniques (sandblasting or grinding with a fine bur) do not affect the high strength of Lava zirconium oxide (> 1200 MPa). However, coarse grinding (125–150 μm) may decrease the strength.

Flexural Strength of Lava™ Zirconium Oxide Without Treatment and after Grinding or Abrasion



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Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Strength after Abrasion, Grinding or Silica-coating (Rocatec™/Cojet)

2

Flexural Strength of High-strength Ceramics after Sandblasting

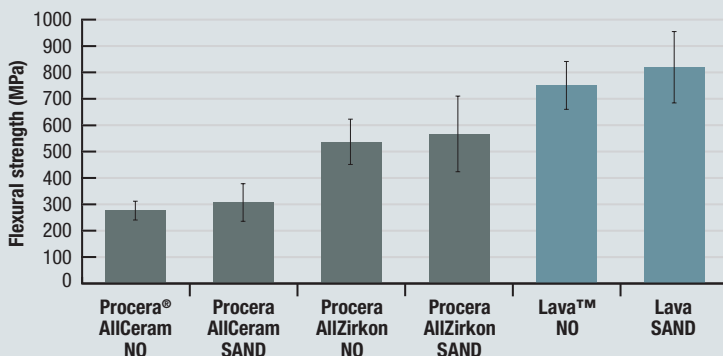
Published at: 1757 IADR 2005

J.L. CHAPMAN,¹ D.A. BULOT,² A. SADAN¹ and M.B. BLATZ,^{1,1} Louisiana State University, New Orleans, USA, ² Louisiana State University, Health Sciences Center School of Dentistry, New Orleans, USA

Aim of the Study: The aim of the study was to show that sandblasting has no effect on the strength of Lava™ zirconium oxide.

Results of the Study: The flexural strength of the high-strength ceramic material zirconium oxide is not affected by sandblasting with grain sizes of 60 µm. Moreover, Lava zirconium oxide shows a higher strength compared to other high-strength ceramics in the market.

Fracture Strength of Different Zirconium Oxide Materials (as milled = NO, SAND = sandblasting)



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Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Strength after Abrasion, Grinding or Silica-coating (Rocatec™/Cojet)

Fracture Strength of Sandblasted and Silicized Colored and Non-colored Zirconia

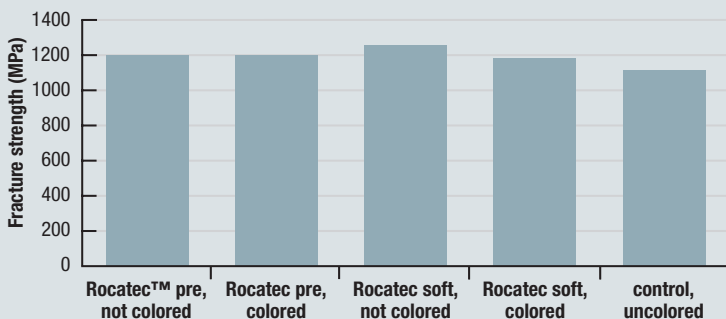
Published at: 0558 IADR 2005

A. BEHRENS, H. NESSLAUER and H. HAUPTMANN, 3M ESPE AG, Seefeld, Germany

Aim of the Study: The aim of the study was to show that there is no strength decrease of colored or uncolored Lava™ zirconium oxide due to sandblasting or silicacoating (Rocatec™ treatment).

Results of the Study: The strength of Lava zirconium oxide is not significantly reduced by sandblasting or Rocatec treatment with grain sizes of 30 μm.

Fracture Strength of Sandblasted and Silicized (Rocatec™) Zirconium Oxide



Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Strength after Abrasion, Grinding or Silica-coating (Rocatec™/Cojet)

2

Effect of Silicacoating on Biaxial Flexural Strength of Zirconia Ceramic

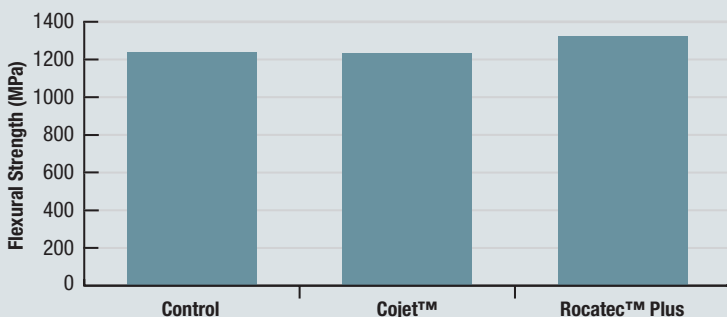
Published at: 0571 CED 2005

L. LASSILA, T. HEIKKINEN, J. MATINLINNA, and P.K. VALLITTU, University of Turku, Finland

Aim of the Study: The aim of the study was to analyse the effect of Rocatec treatment on the flexural strength of 3M™ ESPE™ Lava™ Zirconium oxide.

Results of the Study: There was no significant difference in the flexural strength between silica treatment with 30 μm (Cojet treatment) and the Control. However silica treatment with 110 μm (Rocatec Plus) significantly increased the strength.

Flexural Strength of Lava zirconium oxide after Silica-coating



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Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Long-term Stability of ZrO₂ Specimens

Masticatory Fatiguing Effects on a Yttria-stabilized Zirconia Ceramic

Published at: IADR 2005 Abstract 0562 I. Dent. 2006, 34, 5, 317–25

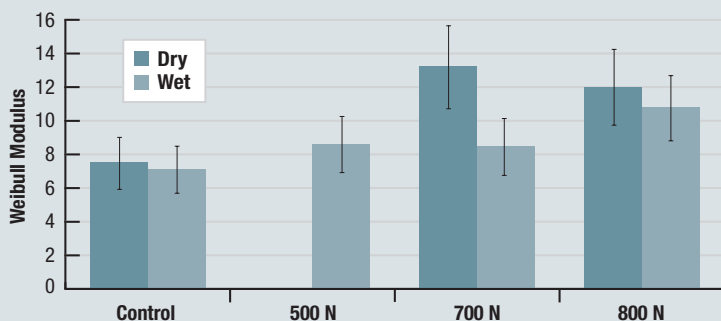
A.R. CURTIS and G.J. FLEMING, University of Birmingham, United Kingdom

Aim of the Study: The influence of masticatory loading on the strength of Lava™ zirconium oxide was analyzed.

Results of the Study: The fatiguing by cyclic loading did not significantly influence the strength of Lava zirconium oxide, and also moisture was not identified to have a detrimental influence, which underlines the longterm stability of the material. Moreover, the reliability of the Lava™ zirconium oxide was even increased by fatiguing.

The figure shows the increasing reliability of Lava zirconium oxide with cyclic fatiguing. The Weibull modulus is an indication of the reliability of a ceramic material.

Weibull Modulus After Cyclic Fatiguing with Different Loads



Lava™ Crowns and Bridges

2.1 Strength of ZrO₂ Specimens

Long-term Stability of ZrO₂ Specimens

2

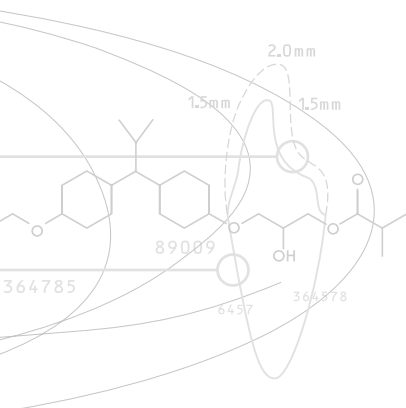
Longevity of an All-Ceramic System in Mouth-Motion Fatigue

Published at: 1959 IADR 2006

Y. ZHANG¹, B.-K. KIM¹, I. HERMANN², M. PINES¹, B.R. LAWN², V.P. THOMPSON¹, and E.D. REKOW¹, ¹New York University, USA, ²National Institute of Standards and Technology, Gaithersburg, MD, USA

Aim of the Study: The aim of the study was to analyse the failure mode of veneered Zirconia specimens (3M™ ESPE™ Lava™ Ceram on Lava Zirconia) after cyclic loading in comparison to veneered metal specimens (metal ceramic specimens).

Results of the Study: Similar to the ceramic-metal systems, fracture in veneered Lava Zirconia specimens is limited to damage modes in the veneer layer. Bulk fracture, common in veneered alumina, is not found. The fracture mode of veneered zirconia is similar to veneered metal.



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Lava™ Crowns and Bridges

2.2 Fracture Strength of FPDs

Strength of 4-unit Bridges

In vitro Fracture Resistance of 4-unit All-ceramic Fixed Partial Dentures

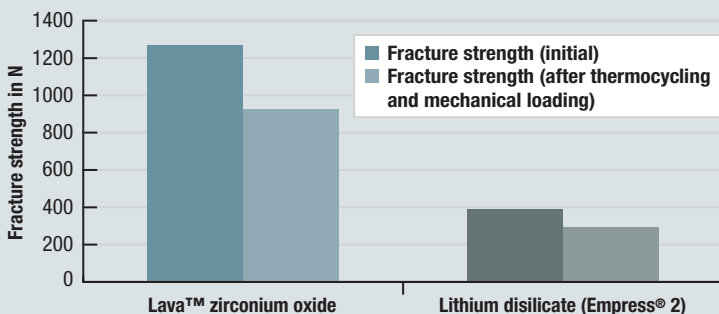
Published at: 0555 IADR 2005

M. STIESCH-SCHOLZ, P. SCHNEEMANN and L. BORCHERS, Medical University of Hannover, Germany

Aim of the Study: The influence of preliminary mechanical damage as well as artificial aging on the strength of 3M™ ESPE™ Lava™ zirconium oxide 4-unit bridges in comparison to glass ceramic 4-unit restorations was analyzed.

Results of the Study: The cyclic thermomechanical loading resulted in a reduction of fracture resistance for 4-unit bridges of both materials, while the mechanical pre-damage of the selected magnitude had no influence on loading capacity. Moreover, Lava zirconium oxide showed a three times higher fracture strength.

Fracture strength of 4-unit Lava™ Bridges with two pontics (initial and after thermocycling and mechanical loading)



Lava™ Crowns and Bridges

2.2 Fracture Strength of FPDs

Strength of 4-unit Bridges

2

Investigation of Connector Cross Sections for 4-unit Zirconia Oxide Bridges

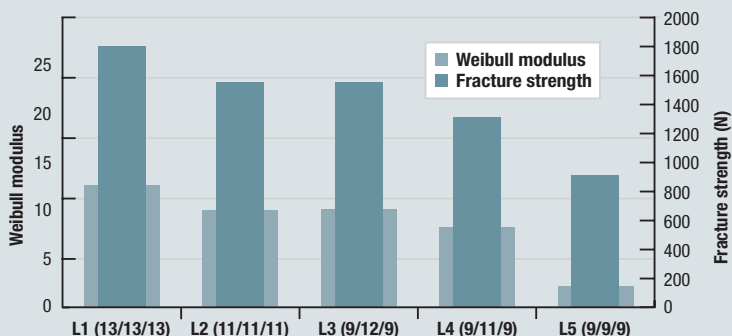
Published at: 0723 IADR 2003

H. HAUPTMANN and B. REUSCH, 3M ESPE AG, Seefeld, Germany

Aim of the Study: Connector cross sections of bridges should be as small as possible due to aesthetic and functional reasons, but are often limited by the mechanical properties of the materials used. Some glass ceramics demand a connector cross section of 16 mm². The aim of this study was to obtain information about the stability of different connector cross sections for 3M™ ESPE™ Lava™ bridges out of zirconium oxide.

Results of the Study: Based on the results for 4-unit Lava bridges out of zirconium oxide, a connector cross section of 9/12/9 mm² is recommended for posterior bridges optimizing aesthetic as well as functional demands.

Weibull Strength Dependent on Connector Cross Sections



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Lava™ Crowns and Bridges

2.2 Fracture Strength of FPDs

Strength of 3- and 4-unit Bridges

Invitro Investigations on the Fracture Strength of All-ceramic Posterior Bridges of ZrO₂ ceramic

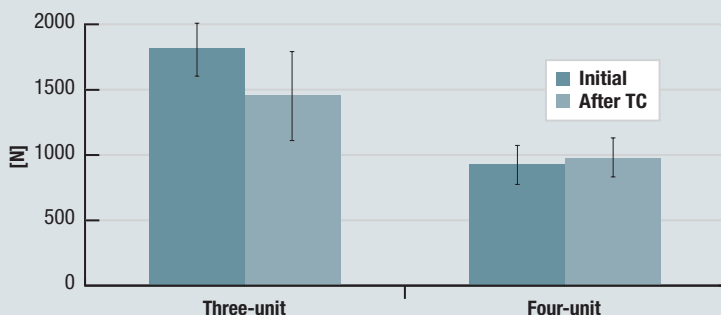
Published at: 173 IADR 2001

P. ROUNTREE, F. NOTHDURFT and P. POSPIECH, Dept. of Prosthodontics, Ludwig-Maximilians-University of Munich, Germany

Aim of the Study: The aim of this invitro study was to investigate the influence of artificial aging on the fracture strength of 3- and 4-unit posterior 3M™ ESPE™ Lava™ bridges out of zirconium oxide as core material.

Results of the Study: The fracture strength of 3-unit and 4-unit bridges is sufficiently high for their use in the posterior region, even after thermocycling.

Fracture Strength Initially and After Thermocycling



Lava™ Crowns and Bridges

2.2 Fracture Strength of FPDs

Strength of 3-unit Bridges

2

Fracture Resistance of Posterior All-Ceramic Zirconia Bridges

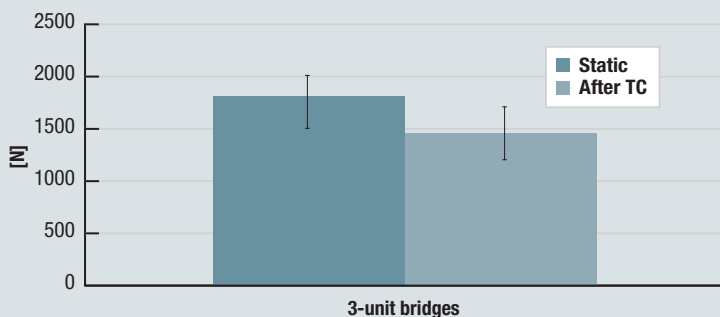
Published at: 910 IADR 2001

D. SUTTOR, H. HAUPTMANN, S. FRANK and S. HOESCHELER, 3M ESPE AG, Seefeld, Germany; P. POSPIECH, LM University of Munich, Germany

Aim of the Study: The aim of this study was to compare the initial static and fatigue fracture resistance of 3-unit all-ceramic posterior 3M™ ESPE™ Lava™ bridges based on zirconium oxide and veneered with Lava™ Ceram.

Results of the Study: Fatigue leads to a strength reduction, but the overall strength level of Lava™ bridges is still very high for the use in the posterior region.

Fracture Strength Initially and after Thermocycling



Text and graphics above refer to branded products offered by various companies. For trademark information, please see the back page of this brochure.

Lava™ Crowns and Bridges

2.2 Fracture Strength of FPDs

Strength of 3-unit Bridges

Fracture Strength of Tooth-colored Posterior Fixed Partial Dentures

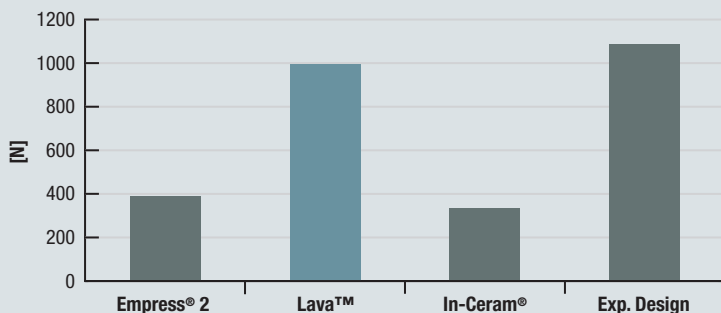
Published at: 174 AADR 2001

M. ROSENTRITT, M. BEHR, R. LAND, S. KLEINMAYER and G. HANDEL, Department of Prosthetic Dentistry, University Clinics, Regensburg, Germany

Aim of the Study: The aim of this invitro study was to determine the fracture strength of adhesively luted tooth colored fixed partial dentures (FPD).

Results of the Study: In comparison to 3M™ ESPE™ Lava™ zirconium oxide the In-Ceram® and Empress® 2 restorations showed significantly lower fracture strength values after thermal cycling and mechanical loading.

Fracture strength after thermal cycling & mechanical loading



Text and graphics above refer to branded products offered by various companies. For trademark information, please see the back page of this brochure.

Lava™ Crowns and Bridges

2.2 Fracture Strength of FPDs

Strength of 3-unit Bridges

2

Fracture Strength of All-ceramic Anterior Fixed Partial Dentures

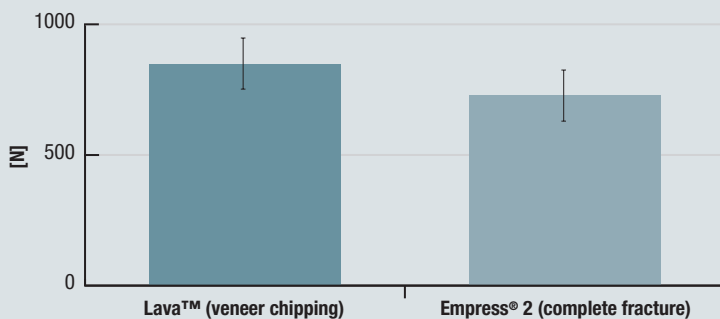
Published at: 998 IADR 2001

K. LUDWIG, M. KERN and S. KLOPFER, Christian-Albrechts-University at Kiel, Germany

Aim of the Study: The aim of this study was to compare the static and fatigue fracture strength of anterior 3-unit fixed partial dentures made from Empress® 2 or Lava™ zirconium oxide veneered with Lava™ Ceram.

Results of the Study: Considering the maximum chewing forces, Lava™ bridges out of zirconium oxide and veneered with Lava Ceram are recommended for 3-unit FPDs with high fatigue resistance.

Fracture Strength of 3-unit Bridges Until Veneer Chipping or Complete Fracture



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Lava™ Crowns and Bridges

2.2 Fracture Strength of FPDs

Strength of Crowns

Fracture Strength of Colored Zirconia Copings with Reduced Wall Thickness

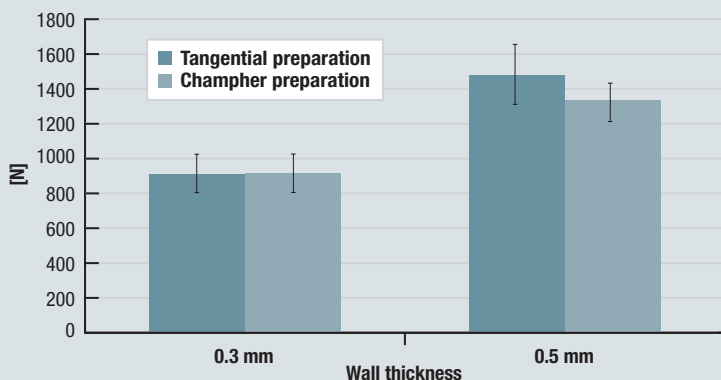
Published at: 115 CED 2004

A. BEHRENS, B. BURGER and H. HAUPTMANN
3M ESPE AG, Seefeld, Germany

Aim of the Study: The aim of the study was to show that a wall thickness of 0.3 mm is sufficient in the anterior region for 3M™ ESPE™ Lava™ crowns out of zirconium oxide.

Results of the Study: The fracture strength of the Lava crowns out of zirconium oxide with reduced wall thickness was about three times higher compared to the expected chewing forces in the anterior region.

Fracture Strength of Copings with Different Wall Thicknesses



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Lava™ Crowns and Bridges

2.3 Surface Conditioning

Optimal Conditions for Silica-coating (Rocatec™/CoJet™)

2

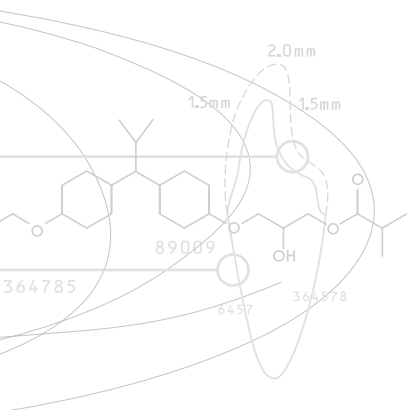
Effect of Some Parameters on Silicadeposition on a Zirconia Ceramic

Published at: 0545 IADR 2005

M. ÖZCAN,¹ L. LASSILA,² J. RAADSCHELDERS,¹ J.P. MATINLINNA² and
P. VALLITTU,² ¹ University of Groningen, Netherlands, ² University of Turku, Finland

Aim of the Study: Optimal conditions for silicacoating of Lava™ zirconium oxide with the CoJet® system was determined.

Results of the Study: Highest silicacoating could be achieved by carefully controlling the angle (45°) of the particle beam to the sample, whereas the treatment duration and distance of the nozzle had only a minor effect.



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Lava™ Crowns and Bridges

2.3 Surface Conditioning

Polishing Performance

Surface Roughness of Stabilized Zirconia Ceramics after Different Polishing Treatments

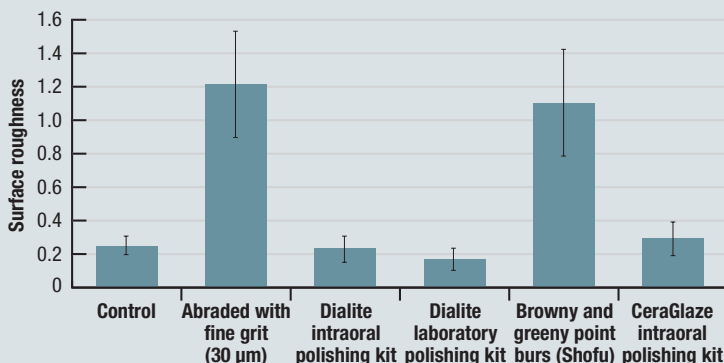
Published at: 3032 IADR 2005

J. FRUGE, N. POTIKET, A. RAIGRODSKI, S. VASTARDIS and N.K. SARKAR, Louisiana State University, New Orleans, USA

Aim of the Study: The aim of the study was to measure the surface roughness of 3M™ ESPE™ Lava™ zirconium oxide ceramic after different finishing procedures.

Results of the Study: Commercial polishing kits such as Dialite™ intraoral, Dialite laboratory and CeraGlaze™ have the ability to polish roughened Lava zirconium oxide to a smooth (Ra 0.170 to 0.293) finish.

Surface Roughness of Zirconium Oxide After Different Polishing Treatments



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Lava™ Crowns and Bridges

2.4 Adhesion to Different Cements

Bond Strength to Cements after Abrasion and/or Silica-coating (Rocatec™/CoJet™)

2

Effect of One-day Storage on Bonding of Self-adhesive Resin Cements

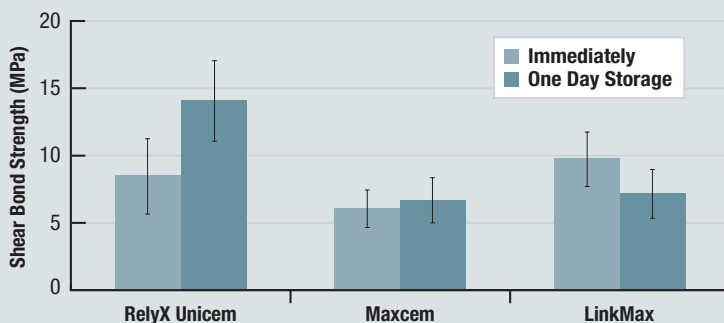
Published at: 1839 AADR 2006

M. IRIE¹, B. RICHTER², and K. SUZUKI¹, ¹Okayama University, Japan, ²3M ESPE AG, Seefeld, Germany

Aim of the Study: The aim of the study was to analyse the shear bond strength of different cements to 3M™ ESPE™ Lava™ Zirconium oxide.

Results of the Study: The self-adhesive cement RelyX™ Unicem showed high bond strength to Lava Zirconium oxide.

Shear Strength of different cements to Lava zirconium oxide



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Lava™ Crowns and Bridges

2.4 Adhesion to Different Cements

Bond Strength to Cements after Abrasion and/or Silica-coating (Rocatec™/CoJet™)

Resin Bonding to Zirconia after Different Surface Treatments

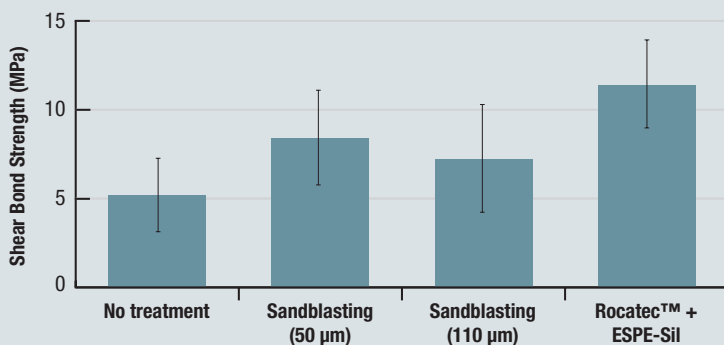
Published at: 0588 CED 2005

D. RE, D. AUGUSTI, D. SPREAFICO, S. CASALI, and G. MOTTA, University of Milan, Italy

Aim of the Study: The aim of the study was to analyse the shear bond strength of 3M™ ESPE™ Lava™ Zirconium oxide to RelyX Unicem™ after different surface treatments.

Results of the Study: Sandblasting increased the shear bond strength significantly. However, the highest strength was achieved after silica-coating (Rocatec™) and silanization (ESPE-Sil).

Shear Bond strength of RelyX Unicem to Lava after different surface treatments



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Lava™ Crowns and Bridges

2.4 Adhesion to Different Cements

Bond Strength to Cements after Abrasion and/or Silica-coating (Rocatec™/CoJet™)

2

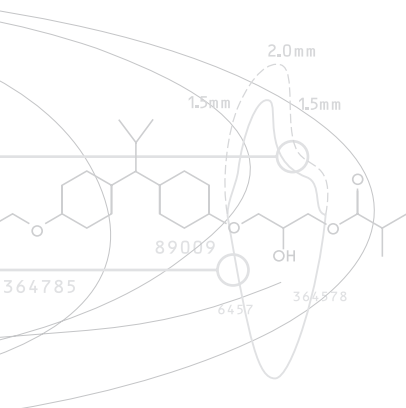
Bond strength of a Self-adhesive Universal Resin Cement to Lava Zirconia after Two Surface Treatments

Published at: 0578 AADR 2003

D. BULOT,¹ A. SADAN,¹ J.O. BURGESS and M. B. BLATZ,^{1,1} Louisiana State University Health Sciences Center School of Dentistry, New Orleans, USA

Aim of the Study: This study evaluated the shear-bond strength (MPa) of the self-adhesive universal resin cement RelyX™ Unicem to Lava™ zirconium oxide compared to three common cement systems after pretreatment of air particle abrasion or tribochemical surface treatment with the Rocatec™ System. Shear-bond strengths were measured after 72-h water storage.

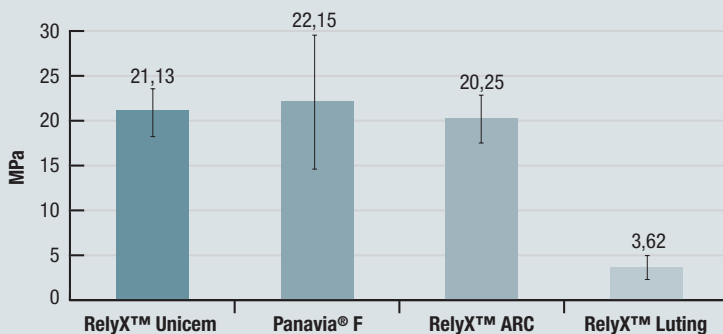
Results of the Study: The self-adhesive resin cement RelyX Unicem revealed bond strengths comparable to or better than the other bonding systems. Surface treatment with the Rocatec System significantly improved bond strength for all bonding systems.



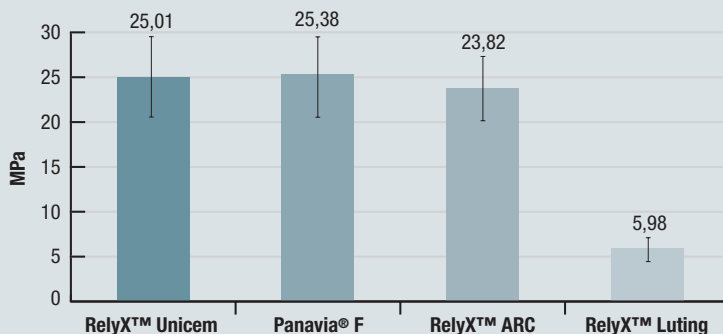
Lava™ Crowns and Bridges

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Shear Bond Strength [MPa] – Pretreatment of Lava™ Zirconium Oxide: Air Particle Abrasion



Shear Bond Strength [MPa] – Pretreatment of Lava™ Zirconium Oxide: Tribochemical Surface Treatment with Rocatec™ System



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For trademark information, please see the back page of this brochure.

Lava™ Crowns and Bridges

2.4 Adhesion to Different Cements

Bond Strength to Cements after Abrasion and/or Silica-coating (Rocatec™/CoJet™)

2

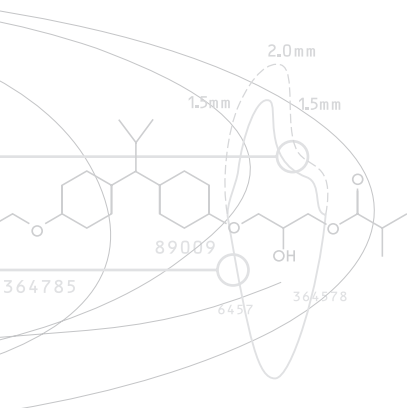
Long-term Shear Bond Strength of Luting Cements to Zirconia Ceramic

Published at: 0060 IADR 2003

A. PIWOWARCZYK, K. LINDEMANN, P. OTTL and H.-C. LAUER, University of Frankfurt, Germany

Aim of the Study: This study evaluated the shear bond strength of different cements to 3M™ ESPE™ Lava™ zirconium oxide after different pretreatments of the zirconium oxide surface and artificial aging after water storage and water storage in combination with thermocycling.

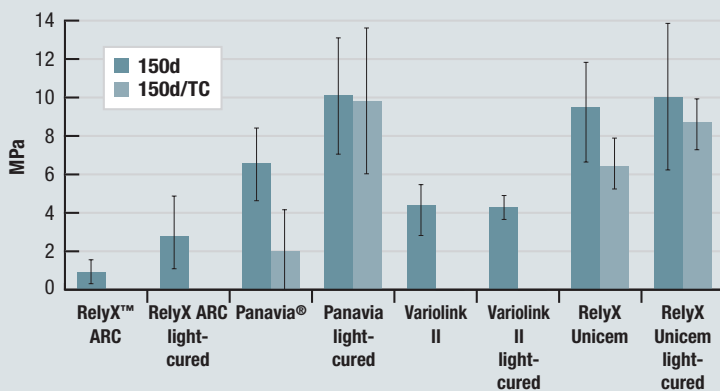
Results of the Study: Air-abraded Lava zirconium oxide showed one of the best bondings to RelyX™ Unicem LC and RelyX Unicem SC of 3M ESPE independent of the artificial aging. This was also confirmed by means of a pretreatment with the Rocatec™ System. Whereas in the case of a pretreatment with the 3M ESPE Rocatec System, the absolute values are higher in comparison to the sand-blasted samples.



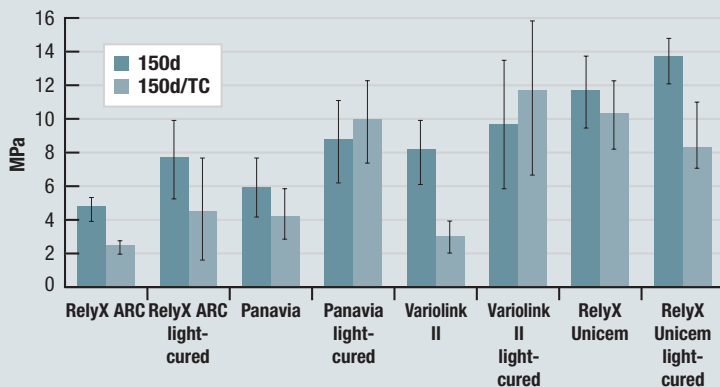
Lava™ Crowns and Bridges

2

Lava™ / Al₂O₃ Shear Bond Strength



Lava™ / Rocatec™ Shear Bond Strength



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Lava™ Crowns and Bridges

2.4 Adhesion to Different Cements

Bond Strength to Cements after Abrasion and/or Silica-coating (Rocatec™/CoJet™)

2

Adhesion of Glass Ionomer Cements to Crowns and Hard Tissues

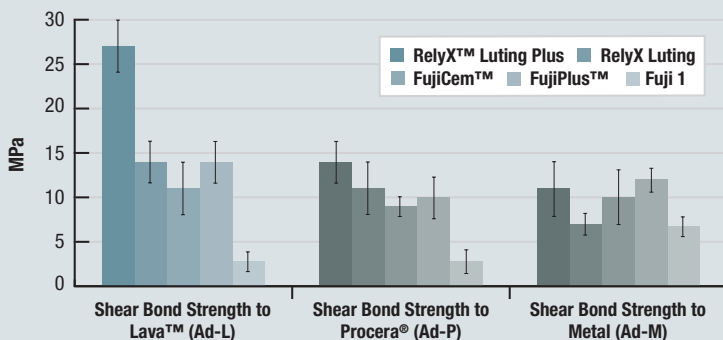
Published at: 3178 IADR 2004

A. FALSAFI, T. T. TON, B.R. BROYLES and D. D. KRUEGER, 3M ESPE Dental Products, St. Paul, MN, USA

Aim of the Study: The aim of the study was to measure shear-bond strength of different self-cure conventional and resin-modified glass ionomer luting cements to 3M™ ESPE™ Lava™ zirconium oxide in comparison to other crown materials.

Results of the Study: 3M ESPE RelyX™ Luting Plus (= ExpC) had significantly higher adhesion to Lava zirconium oxide compared to the other crown and luting materials.

Adhesion of Glass Ionomer Cements to Crowns and Hard Tissues



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Lava™ Crowns and Bridges

2.4 Adhesion to Different Cements

Bond Strength to Cements after Abrasion and/or Silica-coating (Rocatec™/CoJet™)

In Vitro Retentive Strength of Zircon-oxide All Ceramic Crowns

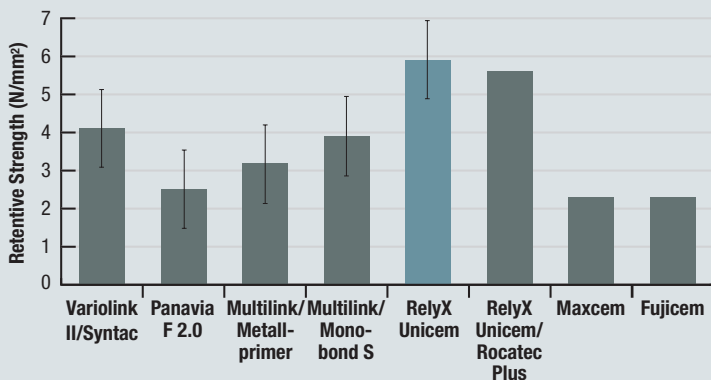
Published at: 1875 AADR 2006

C.-P. ERNST, E. AKSOY, E. STENDER, and B. WILLERSHAUSEN, Johannes Gutenberg University Mainz, Germany

Aim of the Study: Analysis of the retentive strength of 3M™ ESPE™ Lava™ Zirconium oxide crowns cemented on extracted teeth by different cements.

Results of the Study: RelyX™ Unicem showed the highest median retentive strength values. There was no difference between the retentive strength of RelyX Unicem to Lava sand-blasted or silica-coated with Rocatec Plus.

Adhesion of Glass Ionomer Cements to Crowns and Hard Tissues



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Lava™ Crowns and Bridges

2.5 Translucency of Zirconia

Aesthetics

2

Light Transmission Through All-ceramic Framework and Cement Combinations

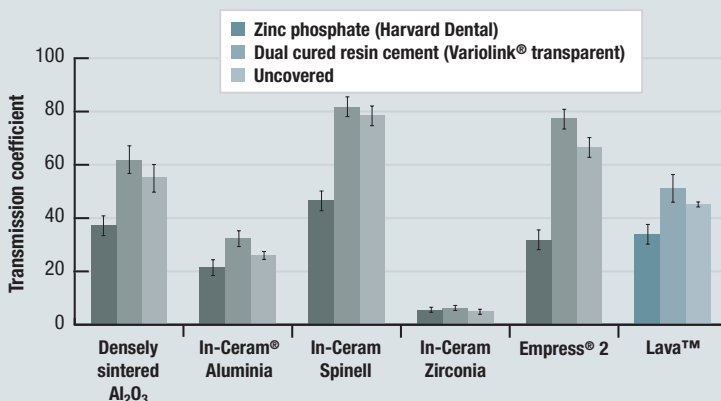
Published at: 1779 IADR 2002

D. EDELHOFF, University of Portland, Germany and J. SORENSEN, Oregon Health & Science University, USA

Aim of the Study: The aim of the study was to show the dependence of light transmission on different luting cements.

Results of the Study: The more transparent materials showed a higher dependence on the luting material. Moreover, 3M™ ESPE™ Lava™ zirconium oxide showed a high translucency compared to other materials like In-Ceram®, even though the lower wall thickness that is necessary for Lava restorations was not considered in this experiment and would further improve the translucency.

Light Transmission Depending on Luting Material



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Lava™ Crowns and Bridges

2.6 Interface Zirconia/Veneering Ceramics

Adhesion to Veneering Porcelain

Shear Bond Strength of Veneering Ceramics to Zirconium-oxide Ceramic

2

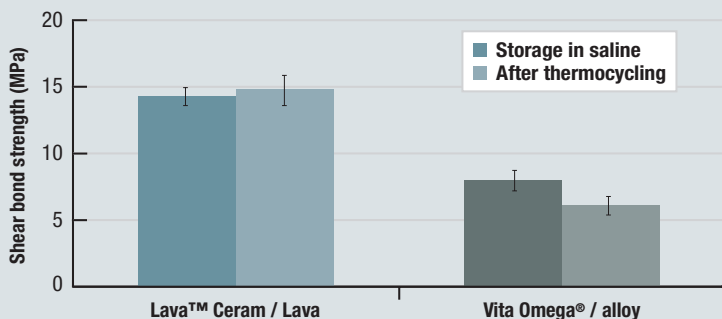
Published at: 0888 AADR 2006

M.B. BLATZ, L. CHAPMAN, G. CHICHE, and D. MERCANTE, Louisiana State University, New Orleans, USA

Aim of the Study: The aim of the study was to analyse the shear bond strength of veneering porcelains to 3M™ ESPE™ Lava™ Zirconium oxide in comparison to the shear bond strength of a veneering porcelain to metal.

Results of the Study: The shear bond strength of veneering porcelain to Lava Zirconium oxide was significantly higher compared to the shear bond strength of veneering porcelain to metal. Thermocycling has no effect on the shear bond strength of Lava Ceram to Lava.

Shear bond strength of veneering ceramics to their respective core ceramic



Lava™ Crowns and Bridges

2.6 Interface Zirconia/Veneering Ceramics

Adhesion to Veneering Porcelain

2

Bonding Characteristics of Lava™ Ceram on Lava Zirconia Core Material

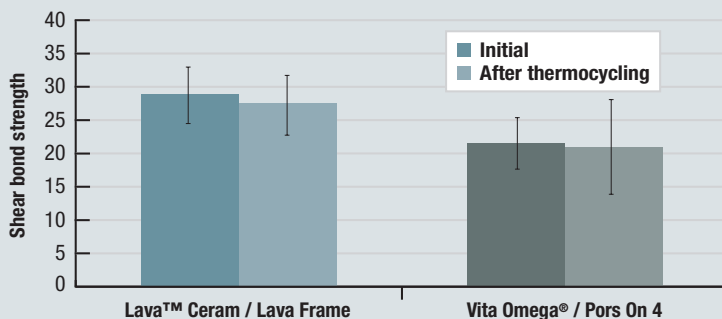
Published at: P77 ADM 2004

A. BEHRENS, B. BURGER and H. HAUPTMANN,* 3M ESPE AG, Seefeld, Germany

Aim of the Study: The aim of the study was to show the bonding mechanism between 3M™ ESPE™ Lava™ zirconium oxide and the veneering porcelain Lava Ceram with respect to the coefficient of thermal expansion and mechanical/chemical bonding.

Results of the Study: The results of this study show a very good and reliable bonding of Lava Ceram on Lava zirconium oxide.

Shear Bond Strength of Veneering Porcelain on Different Core Materials



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Lava™ Crowns and Bridges

2.6 Interface Zirconia/Veneering Ceramics

Optimal Support of the Veneering Ceramics

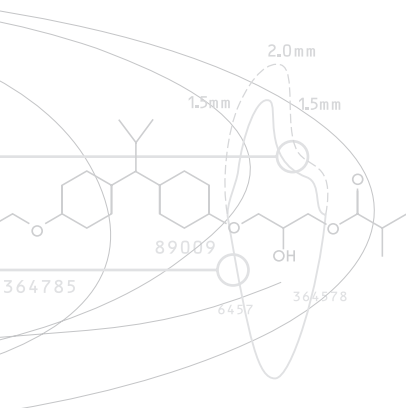
Strength of Zirconia Single Crowns Related to Coping Design

Published at: 0546 IADR 2005

J. FISCHER, Dental School, Bern, Switzerland

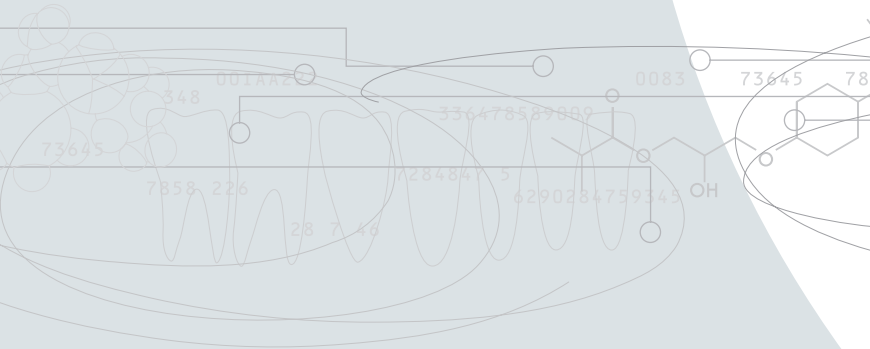
Aim of the Study: The influence of an optimal support of the veneering ceramic by the zirconium oxide framework was analyzed.

Results of the Study: An anatomical design of the zirconium oxide coping created by the wax knife feature of the 3M™ ESPE™ Lava™ software improved the strength of the whole restoration due to optimization of the veneering ceramic layer.



Marginal Quality

3



Lava™ Crowns and Bridges

3 Marginal Quality

Marginal Fit of 4-unit Restorations

Determining the Marginal Fit of CAD/CAM Bridge Frameworks

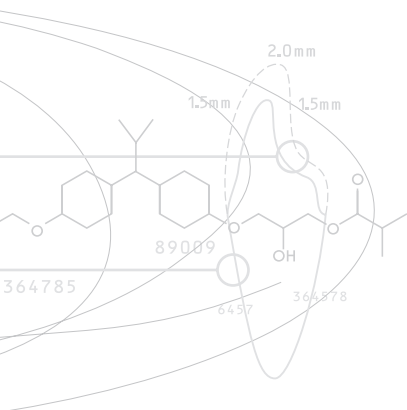
Published at: 0254 PEF 2006

3

PIWOWARCZYK, A. *, LAUER, H.-CH. Department of Prosthodontics, Johann Wolfgang Goethe University, Frankfurt/Main, Germany

Aim of the Study: The aim of the study was to determine the marginal gap of 4-unit bridges milled by different CAD/CAM systems.

Results of the Study: 3M™ ESPE™ Lava Zirconium oxide 4-unit bridges show an excellent marginal gap in comparison to the analyzed competitor systems.

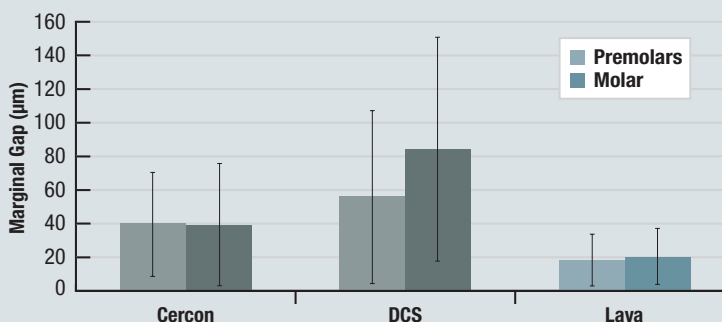


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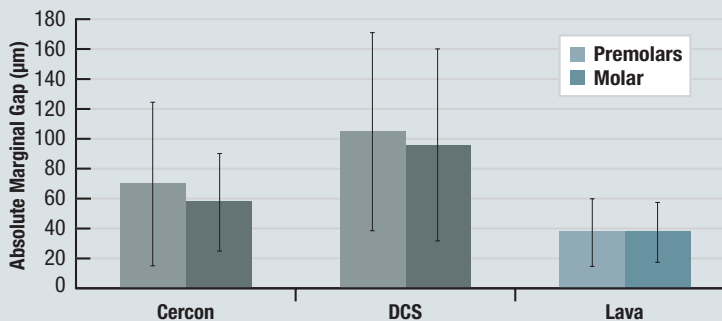
Lava™ Crowns and Bridges

3

Marginal gap of Lava 4-unit restorations in comparison to competitors



Absolute Marginal gap of Lava 4-unit restorations in comparison to competitors



Lava™ Crowns and Bridges

3 Marginal Quality

Marginal Fit of 4-unit Restorations

Marginal Fit of Zirconia Restorations Manufactured with a New Scanner

Published at: 0067 IADR 2006-06-20

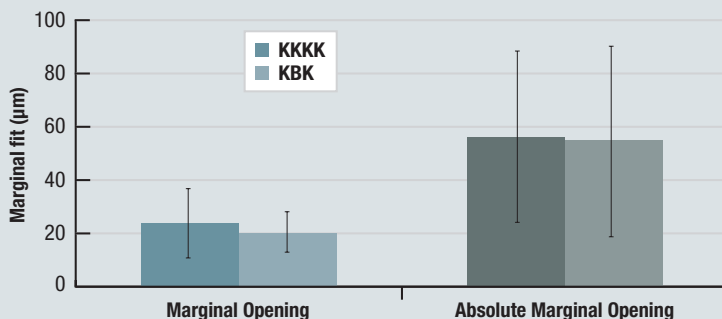
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G. HERTLEIN¹, S. LANGDON², G. CARA³, A. BEHRENS⁴, M. HARTUNG¹, and C. WASTIAN¹, ¹3M ESPE AG, Seefeld, Germany, ²3M ESPE AG, Melbourne, Australia, ³3M ESPE, Sydney, Australia, ⁴3M ESPE, Seefeld, Germany

Aim of the Study: The aim of the study was to determine the marginal fit of a new scanning device.

Results of the Study: With a faster scanning time, the new scanning device shows a very good marginal fit for 4 splinted crowns made of 3M™ ESPE™ Lava™ zirconium oxide.

Marginal fit of 4 splinted Lava crowns and 3-unit Lava bridges



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Lava™ Crowns and Bridges

3 Marginal Quality

Marginal Fit of 4-unit Restorations

Marginal Fit of Zirconia Restorations with Three/Four Abutment Teeth

Published at: 1764 IADR 2005

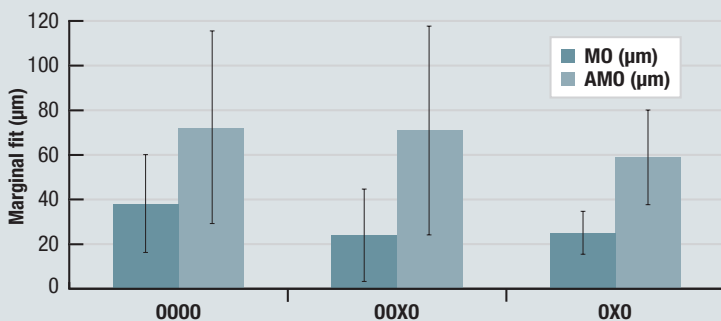
3

G. HERTLEIN, R. FRANKE, C. WASTIAN and K. WATZEK, 3M ESPE AG, Seefeld, Germany

Aim of the Study: The marginal fit of CAD/CAM-fabricated 3M™ ESPE™ Lava™ zirconium oxide restorations with three and four abutment teeth were determined.

Results of the Study: 4-unit bridges with three abutments and 4 splinted crowns made by the 3M ESPE Lava system showed a very good marginal fit.

Marginal Opening (MO) and Absolute Marginal Opening (AMO) of Different Lava™ Indications (O = abutment, X = pontic)



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Lava™ Crowns and Bridges

3 Marginal Quality

Marginal Fit of 3-unit Restorations

Clinical Fit of All-ceramic 3-unit Fixed Partial Dentures, Generated with Three Different CAD/CAM Systems

3

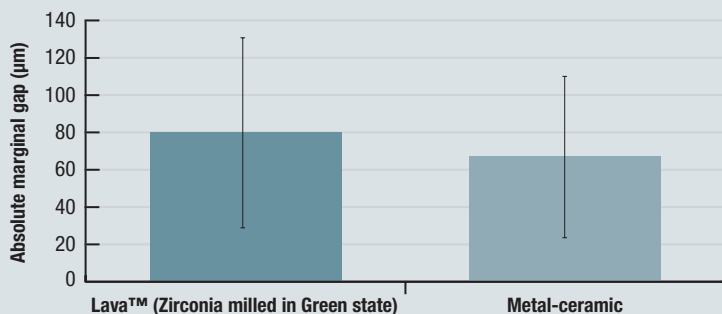
Published at: S. REICH, M. WICHMANN, E. NKENKE and P. PROESCHEL (2005)

Eur J Oral Sci, 113, 174–179

Aim of the Study: The study evaluated the marginal fit of CAD/CAM fabricated restorations in comparison to the marginal fit of metal-ceramic fixed partial dentures.

Results of the Study: No significant difference of the marginal gap of 3-unit porcelain fused to metal 3-unit bridges and 3M™ ESPE™ Lava™ 3-unit bridges could be measured.

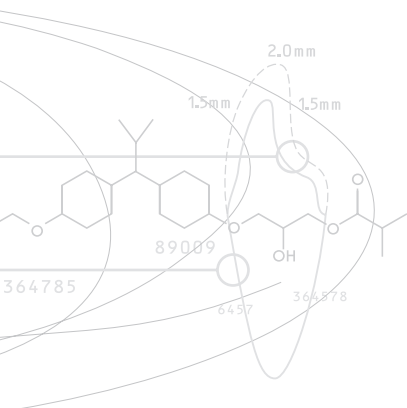
Marginal Gap of Lava™ 3-unit Bridges Compared to PFM



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Lava™ Crowns and Bridges

3



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Lava™ Crowns and Bridges

3 Marginal Quality

Marginal Fit/Microleakage of 3-unit Restorations

Marginal Adaptation of CAD/CAM ZrO₂ Ceramic with Different Cements

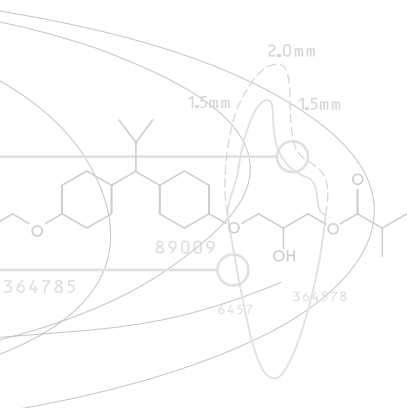
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Published at: 0122 CED 2002

M. ROSENTRITT, M. BEHR, R. LANG, G. GRÖGER and G. HANDEL, Department of Prosthetic Dentistry, University of Regensburg, Germany

Aim of the Study: This study examined the marginal adaptation and marginal seal of fixed Lava™ bridges out of zirconium oxide and veneered with 3M™ ESPE™ Lava™ Ceram that were cemented using different cements and subsequently were exposed to mechanical as well as thermal load in the mastication simulator.

Results of the Study: RelyX™ Unicem of 3M ESPE showed the same excellent results after the stress test as did Panavia® F / ED Primer and Compolute™ / EBS™-Multi.

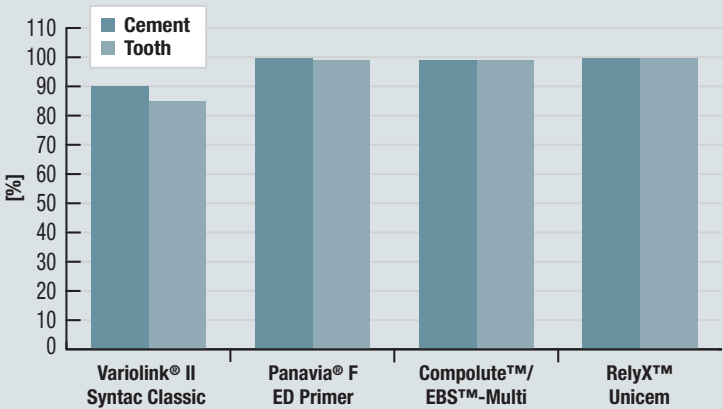


Text and graphics above refer to branded products offered by various companies. For trademark information, please see the back page of this brochure.

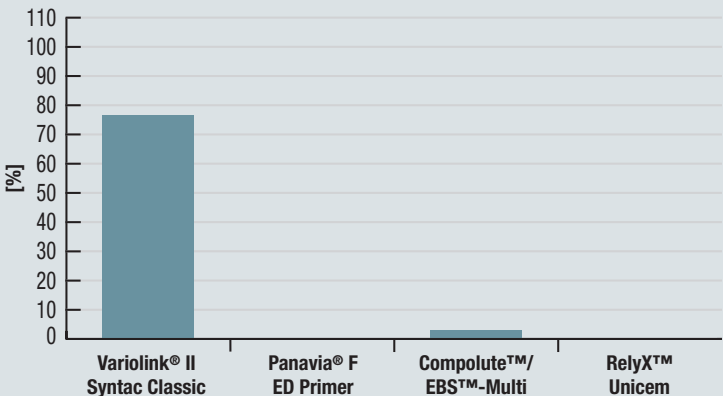
Lava™ Crowns and Bridges

3

Perfect Margin



Microleakage (cement/tooth)



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Lava™ Crowns and Bridges

3 Marginal Quality

Marginal Fit of 3-unit Restorations

Milling Time vs. Marginal Fit of CAD/CAM-manufactured Zirconia Restorations

3

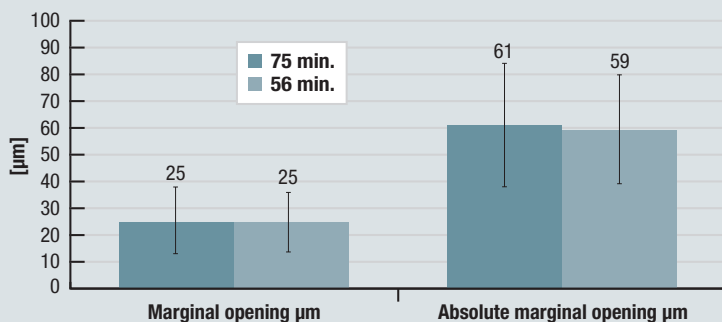
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Aim of the Study: This study evaluated the influence of the milling time and the corresponding milling process optimization steps, respectively, on the marginal fit of 3M™ ESPE™ Lava™ zirconium oxide bridges. The bridges were produced with the Lava™ CAD/CAM System. The time could be reduced by optimizing the milling strategies and the processing parameters.

Results of the Study: No difference between the standard and the faster milling process was observed concerning the marginal fit within the marginal opening and absolute marginal opening groups. The Lava™ System makes it possible to reduce the milling times for 3-unit bridges by 25% while ensuring the same quality.

Marginal Fit depending on Milling Time



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Lava™ Crowns and Bridges

3 Marginal Quality

Marginal Fit of Crowns

Marginal Fit of CAD/CAM Manufactured All Ceramic Zirconia Prostheses

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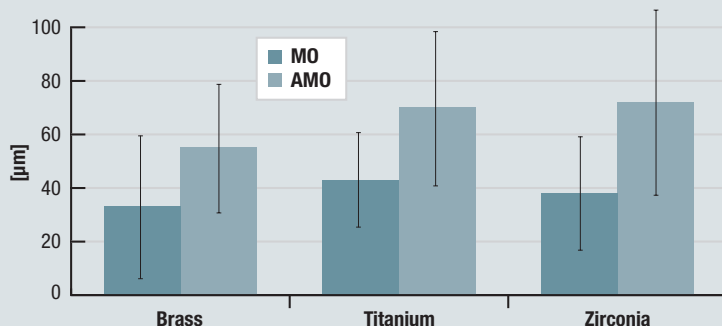
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Aim of the Study: The aim of this work was to verify whether the same precision of fit can be achieved by using either pre-sintered zirconium oxide or metal (brass, titanium) within the CAD/CAM process of the Lava™ System.

Results of the Study: No statistically significant differences between the investigated materials were observed. By using the 3M™ ESPE™ Lava System, pre-sintered zirconium oxide blanks can be machined and sintered to the same high precision as achieved with metals, e.g., titanium. Milled Lava zirconium oxide restorations show an excellent marginal fit.

Marginal Opening (MO) and Absolute Marginal Opening (AMO) of Crowns



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