3M ESPE

# 3M ESPE Products in the Focus of International Science

# Lava™ Crowns and Bridges

In Vivo Clinical Studies,
In Vitro Research
Reviews 2000–2005

3M ESPE

# 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.*
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 *Espertise*™.

Yours sincerely,

Global Technical Director
3M ESPE AG
ESPE Platz
82229 Seefeld

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# Lava™ Crowns and Bridges

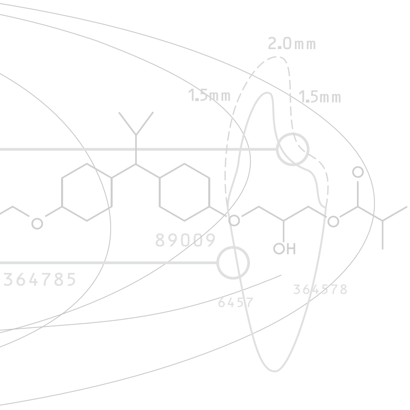
## Official Ratings

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 resorations."
– "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 One-year clinical performance

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

Source: 0226 IADR 2005

A.J. RAIGRODSKI,[1] G.J. CHICHE,[2] N. POTIKET,[2] J.L. HOCHSTEDLER,[2] S.E. MOHAMED,[2] S. BILLIOT[2] 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.*

## Two-year clinical performance

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

Source: 0817 IADR 2003

P.R. POSPIECH,[1] P.R. ROUNTREE[2] 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 from zirconium oxide and veneered with Lava™ Ceram. The mean observation time was 16.8 months.

**Results of the Study:** No total failures, no allergenic 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.

# Lava™ Crowns and Bridges

## 1.1 Clinical Studies

### 1 Three-year clinical performance

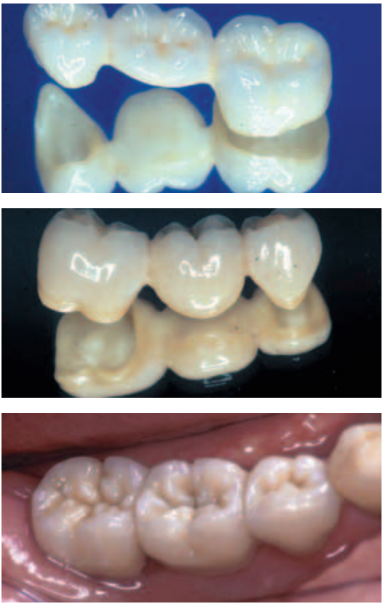
**A Prospective Study on the Long-term Behavior of Zirconia-based Bridges (Lava): Results After Three Years in Service**

Source: 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 allergenic 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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## Clinical relevance of different connector dimensions

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

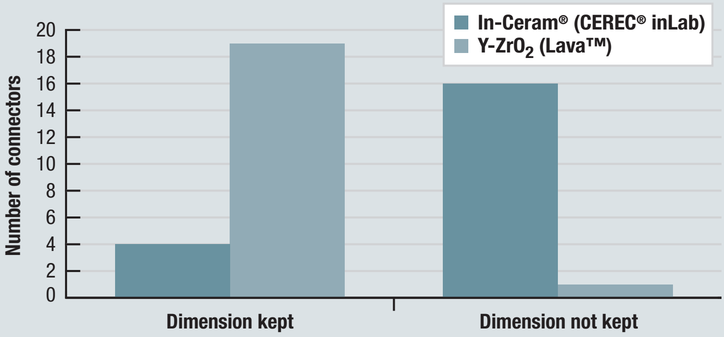
Source: 1355 IADR 2003

S. REICH, University of Erlangen-Nuremberg, Germany

**Aim of the Study:** This study evaluated the clinical practicability of the connector dimensions of In-Ceram® 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 In-Ceram 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

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# Mechanical and Optical Characteristics

2

## 2.1 Strength of $ZrO_2$ Specimens

### Initial strength of $ZrO_2$ specimens



**Fractographic Analysis and Material Properties of a Dental Zirconia**

Source: 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$^{1/2}$ |

## 2.1 Strength of $ZrO_2$ Specimens



### Initial strength of $ZrO_2$ specimens

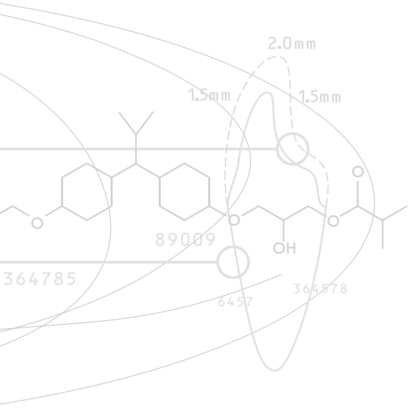
**Material Properties of All-ceramic Zirconia Prostheses**

Source: 2910 IADR 2000

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

**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 $ZrO_2$ Specimens

### Long-term stability of $ZrO_2$ specimens

2

**Masticatory Fatiguing Effects on a Yttria-stabilized Zirconia Ceramic**

Source: 0562 IADR 2005

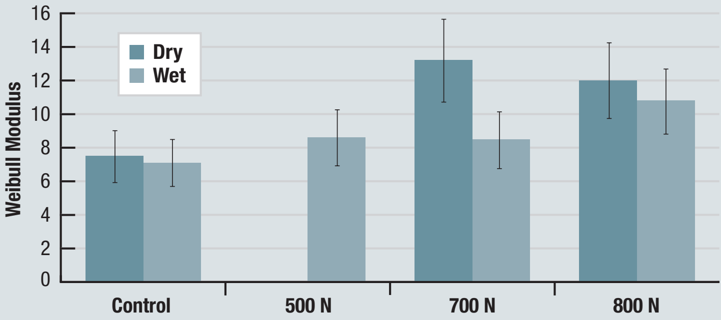
A.R. CURTIS and G.J. FLEMING, University of Birmingham, United Kingdom

**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**



### Strength of colored $ZrO_2$ specimens

**Fracture Strength of Colored vs. Uncolored Zirconia Specimens**

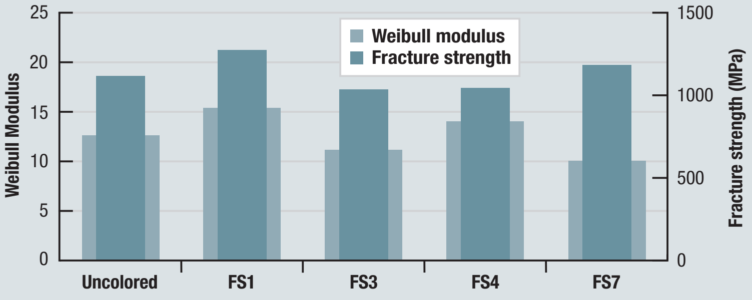
Source: 0243 IADR 2004

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**



## Strength after abrasion and grinding



### Alumina Abrasion and Grinding Effects on Yttria-stabilized Zirconia Ceramic

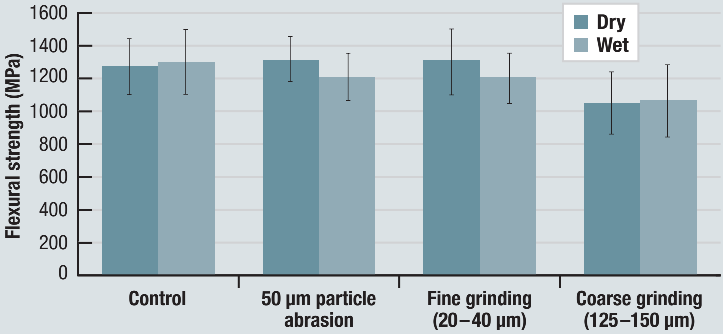
Source: 1339 IADR 2005

G.J.P. FLEMING,[1] A.R. CURTIS[1] 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**



### Strength after abrasion

**Flexural Strength of High-strength Ceramics After Sandblasting**

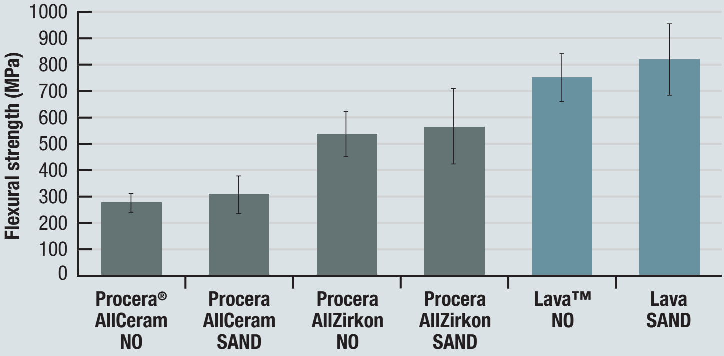
Source: 1757 IADR 2005

J.L. CHAPMAN,[1] D.A. BULOT,[2] A. SADAN[1] 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 $ZrO_2$ Specimens

### Strength after Rocatec™ treatment and abrasion

2

**Fracture Strength of Sandblasted and Silicatized Colored and Non-colored Zirconia**

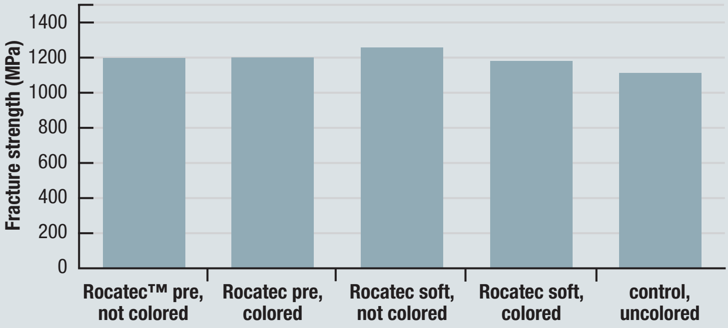
Source: 0558 IADR 2005

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 Silicatized (Rocatec™) Zirconium Oxide**

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# Optimal conditions for Silicacoating (Rocatec™/CoJet™ System)

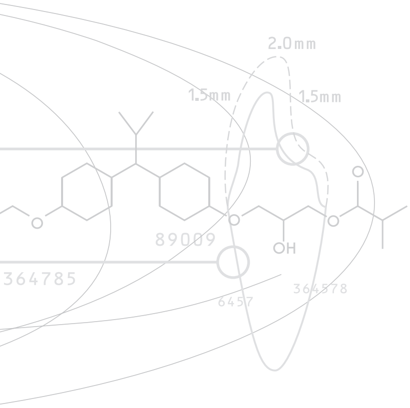
### Effect of Some Parameters on Silicadeposition on a Zirconia Ceramic

Source: 0545 IADR 2005

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

**Aim of the Study:** Optimal conditions for silica-coating 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.



## Polishing performance

2

### Surface Roughness of Stabilized Zirconia Ceramics After Different Polishing Treatments

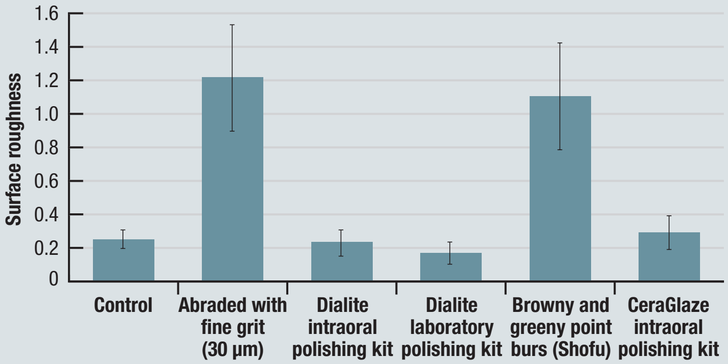
Source: 3032 IADR 2005

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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## 2.2 Fracture Strength of FPDs



### Strength of 4-unit bridges

**Invitro Fracture Resistance of 4-unit All-ceramic Fixed Partial Dentures**

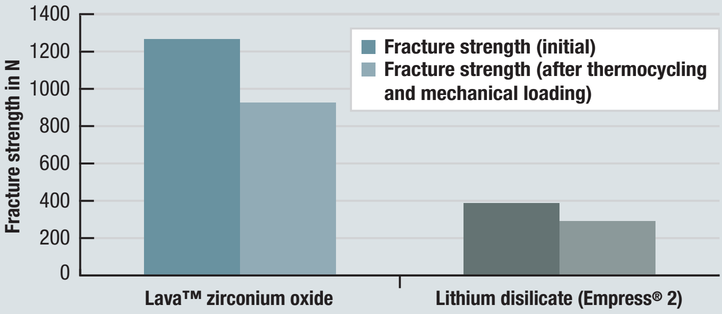
Source: 0555 IADR 2005

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)**



## 2.2 Fracture Strength of FPDs

### Strength of 4-unit bridges

2

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

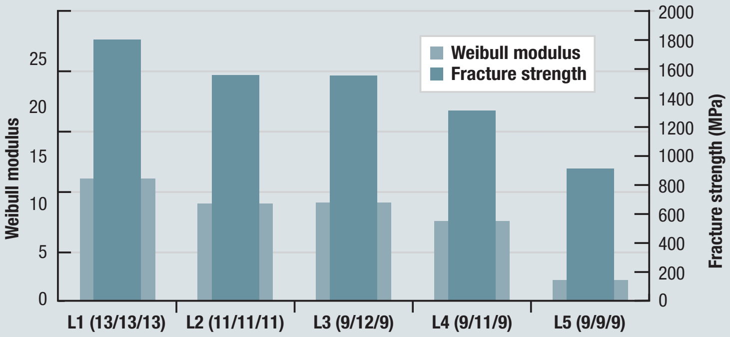
Source: 0723 IADR 2003

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 $mm^2$. 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 $mm^2$ is recommended for posterior bridges optimizing aesthetic as well as functional demands.

**Weibull Strength Dependent on Connector Cross Sections**



## Strength of 3- and 4-unit bridges

**Invitro Investigations on the Fracture Strength of All-ceramic Posterior Bridges of $ZrO_2$ ceramic**

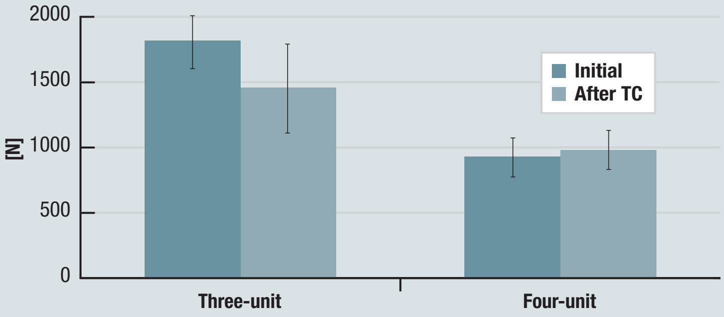
Source: 173 IADR 2001

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



## Strength of 3-unit bridges

2

### Fracture Resistance of Posterior All-Ceramic Zirconia Bridges

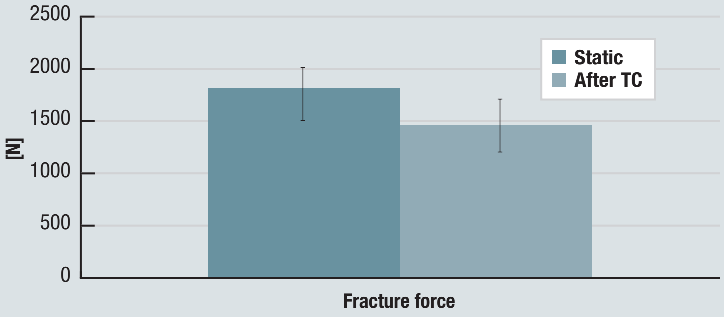
Source: 910 IADR 2001

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**



# Lava™ Crowns and Bridges

## 2.2 Fracture Strength of FPDs



### Strength of 3-unit bridges

**Fracture Strength of Tooth-colored Posterior Fixed Partial Dentures**

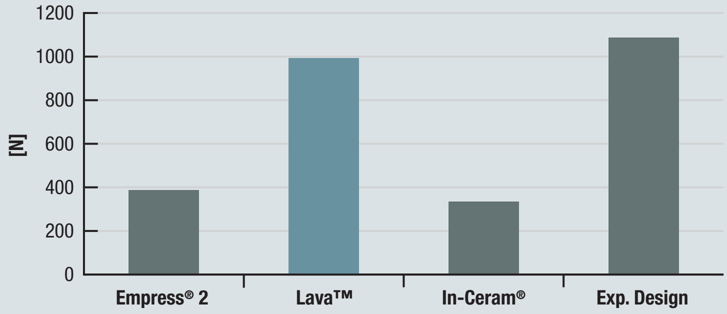
Source: 174 AADR 2001

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**



## 2.2 Fracture Strength of FPDs

### Strength of 3-unit bridges

2

**Fracture Strength of All-ceramic Anterior Fixed Partial Dentures**

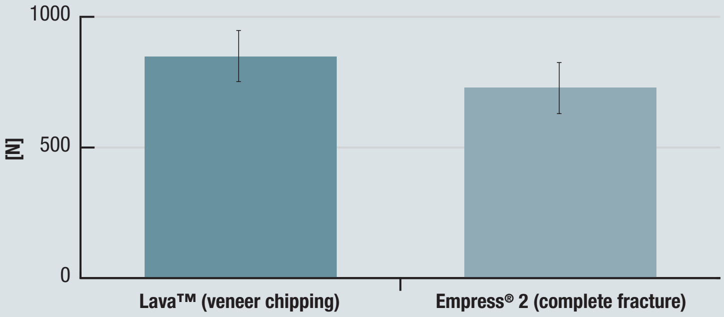
Source: 998 IADR 2001

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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## Strength of crowns

### Fracture Strength of Colored Zirconia Copings with Reduced Wall Thickness

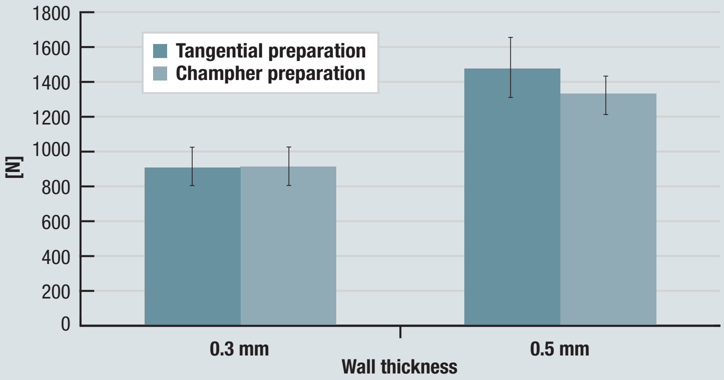
Source: 115 CED 2004

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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# Bond strength after cement abrasion and/or Rocatec™ treatment

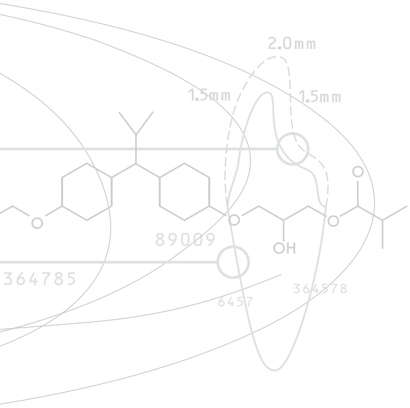
## Bond strength of a Self-adhesive Universal Resin Cement to Lava Zirconia After Two Surface Treatments

Source: 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.

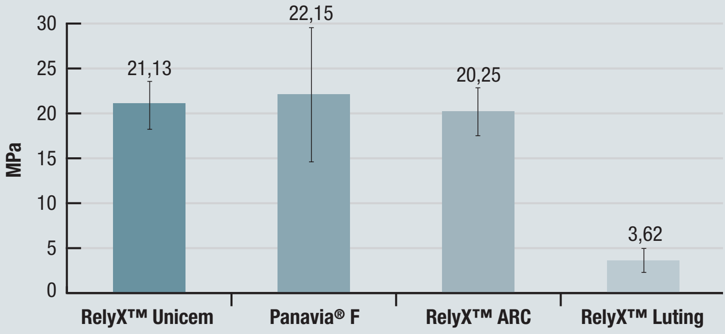
**Results of the Study:** The self-adhesive resin cement RelyX Unicem revealed bond strengths comparable to or better than the other bonding systems. Surface treatment with the Rocatec System significantly improved bond strength for all bonding systems.



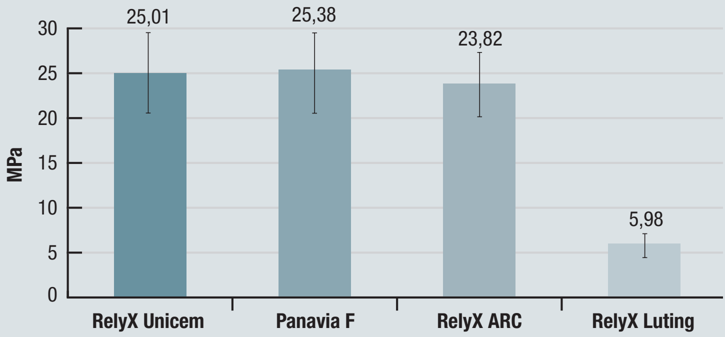
# Lava™ Crowns and Bridges



### 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



# Lava™ Crowns and Bridges

## 2.3 Adhesion to Different Cements



### Bond strength after cement abrasion and/or Rocatec™ treatment

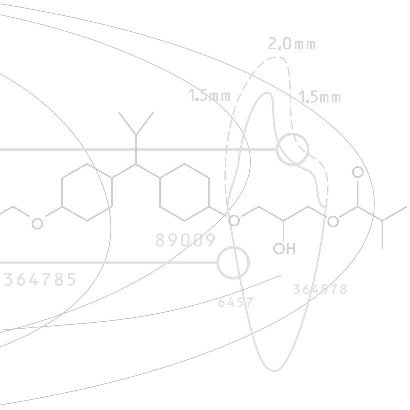
**Long-term Shear Bond Strength of Luting Cements to Zirconia Ceramic**

Source: 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.

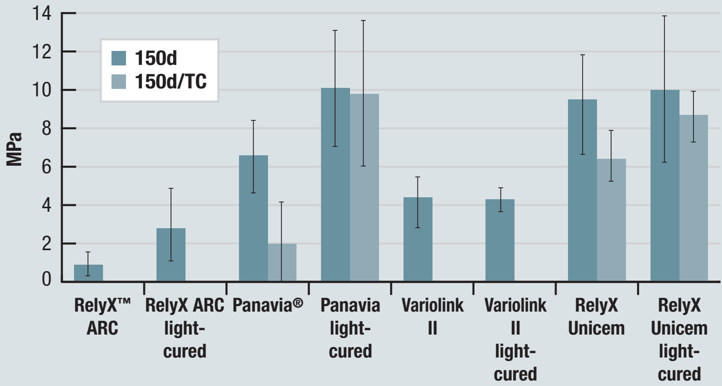
**Results of the Study:** Air-abraded Lava zirconium oxide showed one of the best bondings to RelyX™ Unicem LC and RelyX Unicem SC of 3M ESPE independent of the artificial aging. This was also confirmed by means of a pretreatment with the Rocatec™ System. Whereas in the case of a pretreatment with the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



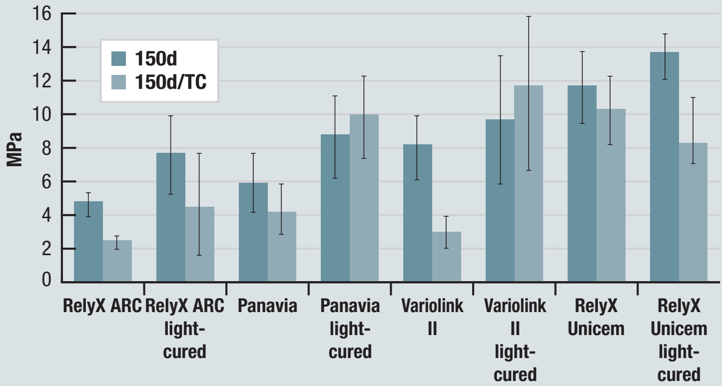
# Lava™ Crowns and Bridges



## Lava™ / $Al_2O_2$ Shear Bond Strength




## Lava™ / Rocatec™ Shear Bond Strength

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## 2.3 Adhesion to Different Cements

2

# Cement bond strength of different crown materials to different cements

### Adhesion of Glass Ionomer Cements to Crowns and Hard Tissues

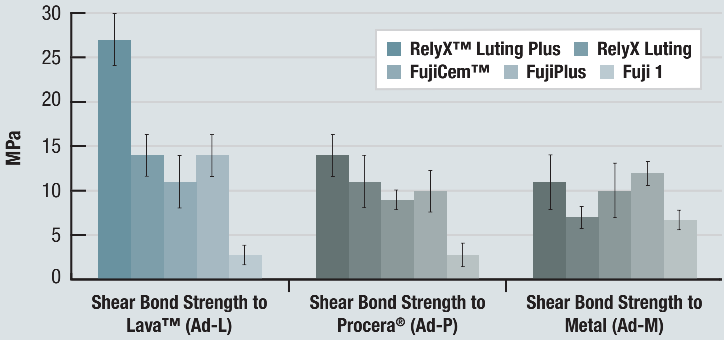
Source: 3178 IADR 2004

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



## 2.4 Translucency of Zirconia



# Aesthetics

### Light Transmission Through All-ceramic Framework and Cement Combinations

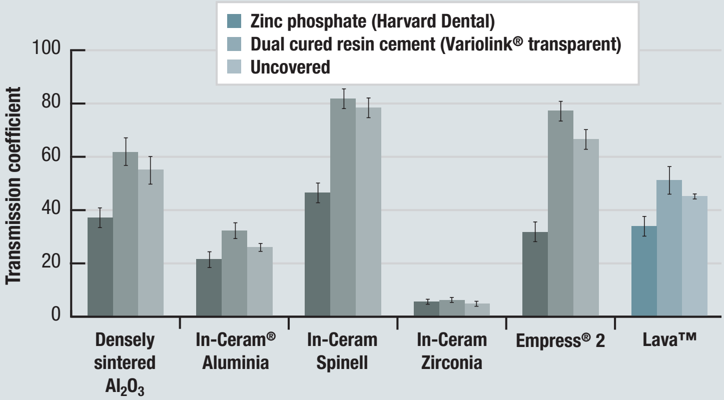
Source: 1779 IADR 2002

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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## Adhesion to veneering porcelain



**Bonding Characteristics of Lava™ Ceram on Lava Zirconia Core Material**

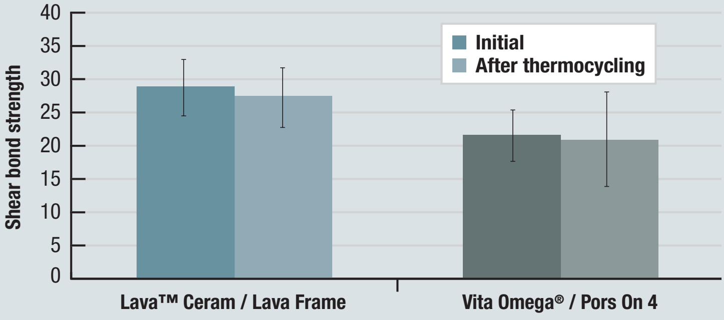
Source: P77 ADM 2004

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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## 2.5 Interface Zirconia/Veneering Ceramics



### Optimal support of the veneering ceramics

**Strength of Zirconia Single Crowns Related to Coping Design**

Source: 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 bridges

**Marginal Fit of Zirconia Restorations with Three/Four Abutment Teeth**

3

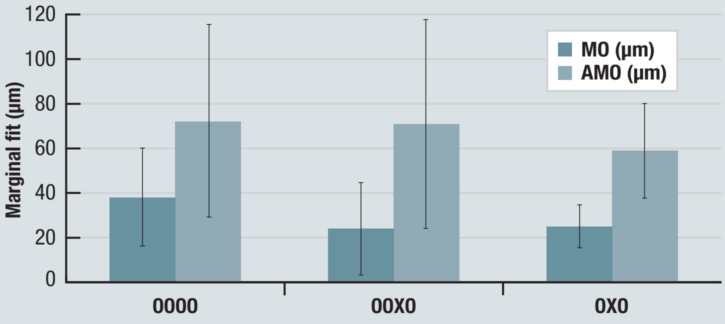
Source: 1764 IADR 2005

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)**



# Lava™ Crowns and Bridges

## 3 Marginal Quality



### Marginal fit of 3-unit bridges

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

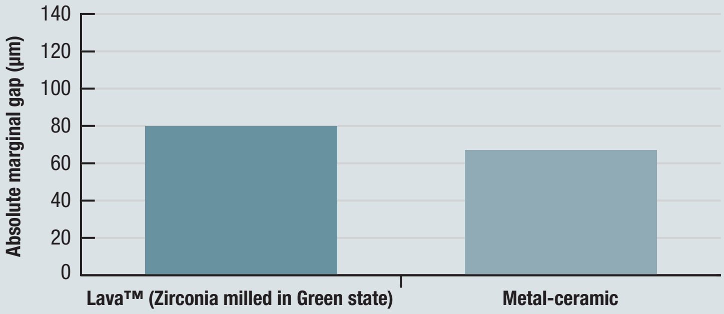
Source: S. REICH, M. WICHMANN, E. NKENKE and P. PROESCHEL (2005)

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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## Marginal fit/Microleakage of 3-unit bridges

### Marginal Adaptation of CAD/CAM $ZrO_2$ Ceramic with Different Cements

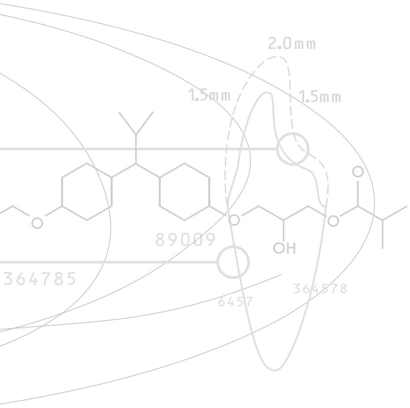


Source: 0122 CED 2002

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 thermical load in the mastication simulator.

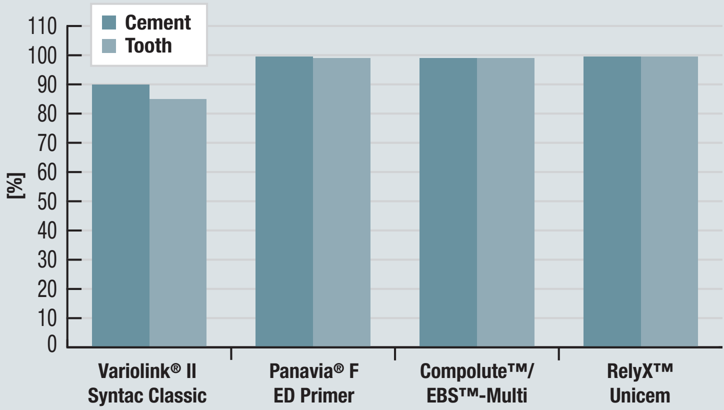
**Results of the Study:** RelyX™ Unicem of 3M ESPE showed the same excellent results after the stress test as did Panavia® F / ED Primer and Compolute™ / EBS™-Multi.



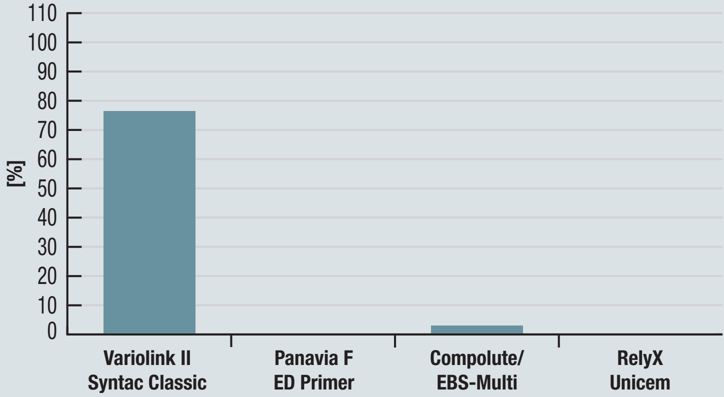
# Lava™ Crowns and Bridges



## Perfect Margin




## Microleakage (cement/tooth)

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## Marginal fit of 3-unit bridges

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

3

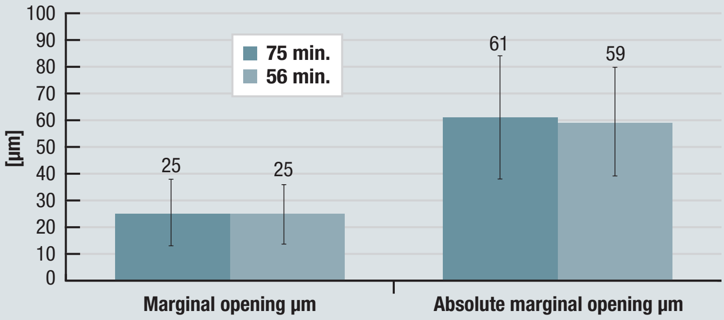
Source: 1455 IADR 2003

G. HERTLEIN, M. KRAEMER, T. SPRENGART, and K. WATZEK, 3M ESPE AG, Seefeld, Germany

**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



# Lava™ Crowns and Bridges

## 3 Marginal Quality



### Marginal fit of crowns

**Marginal Fit of CAD/CAM Manufactured All Ceramic Zirconia Prostheses**

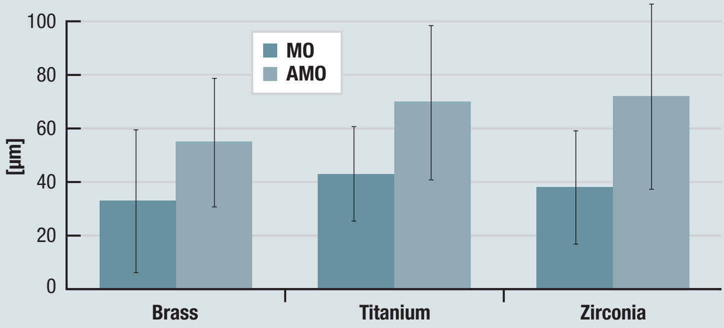
Source: 1092 AADR 2001

G. HERTLEIN*, S. HOESCHELER, S. FRANK, D. SUTTOR, 3M ESPE AG, 82229 Seefeld, Germany

**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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