2017 Oregon Dental Conference®
Course Handout

Jim Kessler, DDS
Course 8116: “Preparation Designs and Laboratory Communication: What your Laboratory Technician Needs to Provide the Best Results”
Thursday, April 6
1:30 pm - 4:30 pm
Preparation Designs & Laboratory Communication

What your Laboratory Technician Needs to Provide the Best Results

...or A Bunch of Stuff Your Laboratory Technician Would Want You to Know

Oregon Dental Conference
April 6, 2017
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At the end of this presentation participants should be able to:
- understand how the esthetic components of shade and translucency are created with today’s all-ceramic materials
- understand the critical information that should be transferred to the dental laboratory for the most predictable results
- recognize the tooth preparation features critical for success with contemporary indirect restorative materials
- be able to confidently establish methods to communicate critical information to the dental laboratory

Creating a Positive Laboratory Relationship

Initiate a genuine atmosphere of trust & respect
Routinely communicate your collaborative successes
Consult early & often in the treatment planning process
Discuss your preferred communication tools & techniques

Communication...
Plane of Occlusion

WHY SPEND THE TIME & MONEY ON A WAX-UP AND PROVISIONALS?

Determine functional & esthetic information that we simply can not visualize
Test our restoration design esthetically and functionally
Align patient expectations with reality
Enhance patient comfort & confidence
Increase the predictability and consistency of our restorations
The ultimate lab communication tool

Images Courtesy of Dr. Jeff Baggett

Images Courtesy of Dr. Bill Robbins

Images Courtesy of Dr. Jeff Baggett
Construction Plane Stick Bite

Esthetic Considerations

Functional Considerations

Aligning Expectations with Reality

Intra-oral mock-up

Matrix for provisional...
and intra-oral "mock-up"

Plane of Occlusion

Case from Advanced Restorative Clinic - University of Oklahoma

Existing Implant

Canted Incisal Edge Plane

Diagnostic Mock-up
Dr. River's Rule of Osseointegration: Implants in unrestorable positions will ALWAYS integrate!

Dr. James Rivers,
Medical University of South Carolina

A DIAGNOSTIC WAX-UP CAN KEEP THIS FROM HAPPENING TO YOU!

Does an Articulator Make Any Difference with Anterior Restorations?
Actual Condylar Inclinations

Right Side: 53 degrees
Left Side: 45 degrees

Does an Articulator Make Any Difference with Posterior Restorations?

Treatment Planning Wax-up
Matrix for provisional...and intra-oral "mock-up"

Reduction Guide
Reduction Guide
Consult early & often in the treatment planning process

Diagnostic Wax-up
Reduction Guide
Prep Examples
Type of Restoration

Discuss your preferred communication tools & techniques

CRITICAL WITH ALL-CERAMIC RESTORATIONS
COMMUNICATE PREP DISCOLORATIONS!

Discuss your preferred communication tools & techniques

Photography is a Powerful Communication Tool

Discuss your preferred communication tools & techniques

PROVISIONALS AS A COMMUNICATION TOOL

FUNCTIONAL & ESTHETIC COMMUNICATION

PROVISIONAL MODELS
INTERMITTENT TOOTH TEST
INTERMITTENT PROVISIONALS

PROVISIONAL MODELS

PROVISIONAL MODELS

FINAL RESTORATION
Discuss your preferred communication tools & techniques

Provisional models

Final Restoration

Discuss your preferred communication tools & techniques

Alternating tooth preps

Five Year Post-op

Discuss your preferred communication tools & techniques

Alternating provisionals

Rubber-Sep Spacer

Diagnostic Mock-up

Common Preparation Problems

Diagnostic Mock-up

Common Preparation Problems
Common Preparation Problems

Inadequate Reduction
- Pulp exposure or pulpal damage

Over-contouring or opaque show-through

Diagnostic Wax-up
- Functional Cusp Bevel
  - Avoid Sharp Line Angles

Reduction Guide
- Functional Cusp Bevel
Occlusal Reduction

Buccal View

Lingual View

Finish Line Design Options for MCR's

Porcelain Margin
Radial shoulder

Metal Margin
Shoulder-bevel

Porcelain Covered
Heavy Chamfer
Metal Margin
or Slanted Shoulder

Finish Line Design Options for MCR's

Porcelain Covered
Metal Margin
Heavy Chamfer
or Slanted Shoulder

Non-Continuous Finish Line

The Dreaded "Coke-Bottle" Prep

Preparation Path of Insertion

Long Axis of Teeth
What is Important with Preparations For All-Ceramic Restorations?

...thickness, rather than inherent properties of the material, is the most important factor relating to the load required to initiate radial fractures.

Can Material Properties Predict Survival of All-Ceramic Posterior Crowns?
Rekow, D., Zhang, Y., Thompson, V.
Compendium, July, 2007

Fracture-proof in dimensions of 1 mm or less

...thickness, rather than inherent properties of the material, is the most important factor relating to the load required to initiate radial fractures.

As the thickness of the ceramic increases, the load required to initiate fracture increases dramatically, as indicated by this term (load to fracture) appearing as the square of the thickness.
Fracture rates of IPS Empress all-ceramic crowns: a systematic review

Heintze, Rousson
International Journal of Prosth., 2010

A ceramic layer of sufficient thickness needs to be ensured.

Material thickness may not equal the amount of reduction (particularly with milled restorations)

The material should not be used in patients with confirmed or suspected bruxism.

Material thickness may not equal the amount of reduction (particularly with milled restorations)

Over-mill 1.5-2.0 mm

Accuracy of CAD/CAM crown fit with infrared and LED cameras

58-67 µm
70-76 µm
185-190 µm

The increasing discrepancies...can be attributed partially to the geometry of the milling burs since the diameter of the milling bur determines the smallest grindable radius of the inner crown contours.

Mean 100 µm (SD 95 µm)

Mean 227 µm (SD 95 µm)
Mean 148 µm (SD 61 µm)
Mean 100 µm (SD 61 µm)

Measurement of crown thickness using thin silicon disc/rule and impression material technique

Sharp incisal line angles are a BIG problem!

Reduce incisal to achieve 1 mm width

Typical anterior over-mill

1.5-2.0 mm

Typical posterior over-mill

58-67 µm
70-76 µm
185-190 µm

This poor adaptation may be a function of the step bur over-milling the internal surface of the crown...by over-milling the intaglio surface can the restoration be seated completely.

Mean 284 µm (SD 95 µm)

Mean 227 µm (SD 95 µm)
Mean 148 µm (SD 61 µm)
Mean 100 µm (SD 61 µm)

Mean 194 µm
70-76 µm
185-190 µm

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Reduce incisal to achieve 1 mm width

Avoid sharp marginal ridges (no bi-concave lingual reduction)

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Milled Restorations

Pressed Restorations

Inadequate Fossa Reduction

Inadequate Fossa Reduction

Inadequate Fossa Reduction

Thin Ceramic

Over bulked lingual

Zirconia based crowns exhibited significantly more loss of retention than metal-ceramic crowns.

"Crowns made out of densely sintered zirconia, however, cannot be recommended as a primary treatment option due to an increased risk of chipping of the veneering ceramic and loss of retention."
Typical Anterior

Indications for Metal-Ceramic Restorations

Zirconia-based restorations require preparations with significant retention and resistance form.
Can & Should Zirconia Be Bonded?

**Means & SD in MPa**

<table>
<thead>
<tr>
<th>Primer</th>
<th>RelyX Unicem</th>
<th>Panavia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alloy Primer</td>
<td>15.9 (6.2)</td>
<td>11.2 (7.9)</td>
</tr>
<tr>
<td>Total bond</td>
<td>7.8 (5.2)</td>
<td>8.2 (6.5)</td>
</tr>
<tr>
<td>Control</td>
<td>7.2 (3.2)</td>
<td>8.6 (6.1)</td>
</tr>
<tr>
<td>Metal Primer II</td>
<td>6.2 (3.2)</td>
<td>9.0 (5.9)</td>
</tr>
<tr>
<td>Metalite</td>
<td>3.6 (5.5)</td>
<td>6.6 (5.6)</td>
</tr>
</tbody>
</table>

MDT (10-methacryloyloxydecyl dihydrogen phosphate)

"Reductions in bond strength up to 87% for Panavia and 66% with RelyX Unicem were observed after 5 months of water storage."

If we could bond zirconia, should we?

Retrievability?

Fatigue Behavior of the Resinous Cement to Zirconia Bond

*Seto K, McLaren E, Caputo A, & White S: Journal of Prosthodontics, 2013*

If we could bond zirconia, should we?

Retrievability?

Therefore, "retrievability" should be a consideration.
Full Coverage Preparations for All-Ceramics with High Strength Cores

Gross Reduction
KS-1
Round-end cylinder, 1.2mm diameter

Incisal depth grooves
1.5-2.0 mm
KS-1 or 330 carbide

Incisal reduction
Interproximal reduction

Labial reduction-First plane

Labial reduction-Second plane
Incisal reduction
Interproximal reduction
Labial reduction-Second plane
Incisal depth grooves
KS-1

Incisal reduction
Interproximal reduction
Labial reduction-Second plane
Incisal depth grooves
Lingual axial reduction

Fossa Reduction
KS-4 or KS-5

Incisal reduction
Interproximal reduction
Labial reduction-First plane
Labial reduction-Second plane
Incisal depth grooves
Lingual axial reduction
Lingual fossa reduction

Refine & Smooth
8847KR 014
Fine Grit
Cylinder with Beveled Flat End

Eliminate All Sharp Line Angles
Reduce incisal to achieve 1 mm width
Incisal reduction
Interproximal reduction
Labial reduction—First plane
Labial reduction—Second plane
Lingual axial reduction
Lingual fossa reduction

Reduce incisal to achieve 1 mm width

Incisal depth grooves

Remove “lip” & Refine Prep

Final Preparation
Refine Prep—Soften All Line Angles

Full Coverage Preparations for All-Ceramics with High Strength Cores

3.5 mm
Radial Shoulder or Chamfer

1.3-1.5 mm
Facial Reduction

1.5 mm Lingual Fossa Reduction

1.5-2 mm
Incisal Reduction

KS-1 1.2 mm dia.

KS-1 1.2 mm dia.

8847KR 014 1.4 mm dia.
Bevel Preparation (metal margins) M885-012 Cylinder with Torpedo Tip

Preparation designs for Posterior Bonded restorations

Posterior All-Ceramic Preparations

Occlusal reduction 1.5-2.0 mm

Occlusal reduction 1.5-2.0 mm

Occlusal reduction 1.5-2.0 mm

Butt Margins in enamel

Occlusal reduction 1.5-2.0 mm

Occlusal reduction 1.5-2.0 mm

Butt Margins in enamel
Occlusal reduction 1.5-2.0 mm
Butt Margins in enamel

Posterior All-Ceramic Preparations
Occlusal reduction 1.5-2.0 mm
Smooth finish line transitions
Adequate cusp support
Isthmus at least 1.5 mm wide
Butt Margins in enamel

Posterior All-Ceramic Preparations
Smooth finish line transitions

Posterior All-Ceramic Preparations
Adequate cusp support

Posterior All-Ceramic Preparations
Occlusal reduction 1.5-2.0 mm
Smooth finish line transitions
Adequate cusp support
Isthmus at least 1.5 mm wide
Butt Margins in enamel
Rounded line angles
Sharp finish lines
Predicting marginal fit of CAD/CAM crowns based on the presence or absence of common preparation errors


Typodont molars prepared by 62 clinicians

Misfits were measured with light-bodied VPS impression material

Marginal gaps were measured as defined by Holmes et al. (the perpendicular measurement from the internal surface of the crown to the preparation closest to the finish line.)

Acceptable Finish Lines

Heavy Chamfer (1mm) Radial Shoulder (1mm)

Light Chamfer (<1mm) Beveled Shoulder

Unacceptable Finish Lines

Lipped Shoulder

"...certain preparation design flaws led to consistently poorer fitting restorations. These flaws included lipped finish lines, sharp cervicoaxial line angles, and beveled and/or spiked and undulating finish lines."

"Errors in preparation design, particularly involving the finish line, may necessitate techniques such as coping with a laboratory using the lost wax technique to fabricate alloy restorations."
Errors in preparation design, particularly involving the finish line, are easier to cope with when a laboratory uses the lost wax technique to fabricate alloy restorations.

1. According to your lecture, the minimum amount of occlusal reduction necessary on a posterior tooth for which a bonded all-ceramic restoration is planned is:
   a. 2.5 mm
   b. 1.0-1.5 mm
   c. 1.5-2.0 mm
   d. >2.5 mm

2. According to the article discussed in your lecture by the author D. Rekow, which of the following plays the greatest part in determining the fracture resistance of an all-ceramic restoration?
   a. the strength of the ceramic material
   b. the thickness of the ceramic material
   c. the anatomy of the restoration
   d. the strength of the cement used to deliver the restoration

3. For which of the following restorative types would over-mill or bur compensation be a significant consideration?
   a. a cast metal restoration
   b. a pressed e.max (lithium disilicate reinforced) restoration
   c. a pressed Empress (leucite reinforced) restoration
   d. any milled all-ceramic restoration
   e. all of the above

4. According to your lecture and the research from Dr. W. Renne, which of the following finish line designs was found to be most acceptable for milled all-ceramic preparations?
   a. a "lipped" shoulder
   b. a beveled shoulder
   c. a knife-edge finish line
   d. a heavy chamfer

5. According to research discussed in your lecture, which of the following interfaces resulted in the least amount of leakage (dye penetration) after bonding and then thermocycling and mechanical loading?
   a. the dentin/resin interface
   b. the enamel/resin interface
   c. the ceramic/resin interface
   d. the cementum/resin interface

Answers:

C
B
D
D
C