High Esthetic Potential for Zirconia Dental Restorations*
New series which features translucency similar to natural tooth enamel is now available.

Introducing the new series of ultra translucent multi-layered UTML and superior translucent multi-layered STML, ideal for efficient esthetic anterior teeth restorations.

These high translucent zirconia materials require different technical methods from the previously introduced ML and HT. This technical guide will explain the important points to help you achieve successful restoration using KATANA™ Zirconia.

*Compared to our conventional products

Four-Layer Structure:
- Enamel Layer (35%)
- Transition Layer 1 (15%)
- Transition Layer 2 (15%)
- Body (Dentin) Layer (35%)

Percentages shown in the brackets reflect the thickness ratio of the disc.

Restoration process
1. Series Selection
2. Shade Selection
3. Disc Thickness Selection
4. Framework Design and Milling Process
5. Sintering and Adjusting
6. Finishing Methods
   - 6-1 Glazing
   - 6-2 Glazing and Staining
   - 6-3 Build-ups

Completion
Each series has different translucency and mechanical properties. By choosing the right series, you can successfully restore a wide-range of cases, from the esthetic anterior to posterior bridgework.

**UTML**  
Ultra Translucent Multi-Layered. Ideal for anterior crowns and veneers, inlays/onlays and posterior single crowns.

**STML**  
Super Translucent Multi-Layered. Ideal for up to 3 units posterior bridges with a well-balanced combination of chromatic and gradational translucency, which reproduces esthetic enamel and dentin effects.

**ML&HT**  
High flexural strength zirconia is suitable for single unit frameworks and long-span bridges.

### Translucency (raw zirconia material) / Transmittance Rate (%)

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTML</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STML</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ML&amp;HT</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Measurement Condition**
- Wavelength of light: 700nm
- Thickness of sample: 0.5mm

### Mechanical Properties (raw zirconia material) / Flexural Strength (MPa)

<table>
<thead>
<tr>
<th></th>
<th>0MPa</th>
<th>200MPa</th>
<th>400MPa</th>
<th>600MPa</th>
<th>800MPa</th>
<th>1000MPa</th>
<th>1200MPa</th>
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<tbody>
<tr>
<td>UTML</td>
<td>557</td>
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<td>STML</td>
<td>748</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ML&amp;HT</td>
<td>1125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Measurement Condition**
- ISO 6872: 2015 (Three-point bending test)
- Distance: 30mm
- Sample size: 40mm x 4mm x 3mm

### Recommendations for each series

#### Recommended Applications*

- **UTML**: Veneer, Inlay/Onlay, Anterior Crown
- **STML**: Inlay/Onlay, Anterior Crown, Posterior Crown
- **ML&HT**: Anterior Crown, Posterior Crown, 3 Unit Bridge, Long-span Bridge

*HT is recommended for the framework if you overlay with layered porcelains.
Shade Selection

**UTML Shades**

There are two different shade groups: “Standard Shades” and “Enamel Shades”. Enamel Shades have reduced chroma in the upper layer (1) which allows you to enhance the translucent appearance of the incisal area, as desired, by utilizing external stain characterization.

**STML Shades**

A well-balanced combination of chromatic and gradational translucency reproduces esthetic enamel and dentin effects.

**ML & HT Shades**

ML (Multi-Layered) is suitable for full contour crowns and bridges, and HT (High-Translucent) Monolithic Shaded is suitable for frameworks.

<table>
<thead>
<tr>
<th>Series</th>
<th>ML</th>
<th>HT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B-Light</td>
<td>C-Light</td>
</tr>
</tbody>
</table>
### Shade Selection

<table>
<thead>
<tr>
<th>Series</th>
<th>Standard Shades</th>
<th>Enamel Shades</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UTML</strong></td>
<td>A1 A2 A3 A3.5 A4 B1 B2 B3 B4 C1 C2 C3 C4 D2 D3 D4</td>
<td>ENW EA1 EA2 EA3</td>
</tr>
<tr>
<td><strong>STML</strong></td>
<td>NW A1 A2 A3 A3.5 A4 B1 B2 B3 C1 C2 C3 D2 D3</td>
<td></td>
</tr>
<tr>
<td><strong>ML</strong></td>
<td>A-White A-Light A-Dark B-Light C-Light D-Light</td>
<td></td>
</tr>
<tr>
<td><strong>HT</strong></td>
<td>HT10 HT12 HT13</td>
<td></td>
</tr>
</tbody>
</table>

#### Recommendations for Shade Selection

1. Range of abutment color varies by translucency of the series.

   ![Abutment color examples](image)

   *Select the shade number that corresponds to the target color.*

   *Select a shade number one level brighter than the target color (with external staining).*

2. Zirconia with a high refractive index tends to look brighter on the posterior area. For posterior restorations using UTML or STML, choose one shade darker than the target shade to achieve a natural look with surrounding teeth.

3. Even when the same shade color is used, the glazing and polishing finish will result in different color outcomes.

   - **For glazing,** select the target shade color, and for polishing, it tends to become one shade darker. Therefore, select one lighter shade than the target shade color.
   - **For polishing,** select the target shade color, and for glazing, it tends to become lighter. Therefore, adjust the color by external staining.
Multi-Layered UTML, STML and ML discs come in three thicknesses: 14, 18 and 22mm. When sintering, the thickness will reduce to 80%. Therefore, select the right disc thickness to achieve the appropriate gradation between the crown length the enamel to the body (dentin).

<table>
<thead>
<tr>
<th>Layer</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enamel Layer</td>
<td>35%</td>
</tr>
<tr>
<td>Transition Layer 1</td>
<td>15%</td>
</tr>
<tr>
<td>Transition Layer 2</td>
<td>15%</td>
</tr>
<tr>
<td>Body (Dentin) Layer</td>
<td>35%</td>
</tr>
</tbody>
</table>

Thickness after sintering (before sintering)
11.2mm (14mm)     14.4mm (18mm)        17.6mm (22mm)

Example: Fabricating an anterior crown with 11mm length, use an 18mm disc (14.4mm after sintering) including the enamel layer to the body (dentin) layer. For the 7mm posterior crown fabrication, a 14mm disc (11.2mm after sintering) is recommended between enamel and body (dentin) layers.

Framework Design and Milling Process

Anterior crown, Veneer, Posterior crown, Inlay, Onlay

It is crucial to keep a minimum wall thickness* for a successful restoration, and keep in mind:

*Not including the thickness of build-up porcelain

Minimum Wall Thickness of Zirconia

<table>
<thead>
<tr>
<th>UTML</th>
<th>STML</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8mm</td>
<td>0.8mm</td>
</tr>
<tr>
<td>0.8mm</td>
<td>0.8mm</td>
</tr>
<tr>
<td>0.4mm</td>
<td></td>
</tr>
</tbody>
</table>

Anterior crown  Veneer  Posterior crown  Inlay  Onlay

ML&HT

<table>
<thead>
<tr>
<th>Anterior crown</th>
<th>Veneer</th>
<th>Posterior crown</th>
<th>Inlay</th>
<th>Onlay</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8mm</td>
<td>0.4mm</td>
<td>0.5mm</td>
<td>0.5mm</td>
<td>0.5mm</td>
</tr>
<tr>
<td>0.4mm</td>
<td></td>
<td>0.5mm</td>
<td>0.5mm</td>
<td></td>
</tr>
</tbody>
</table>

*Keep 0.8mm in case of porcelain build-up. You can reduce to 0.4mm when finishing with glaze and polish.

Contraindications

- "J" Margin
- Deep Shoulder
- Knife Edge
- Undercuts
- Rough Margin
- Groove
- Parallel Axis
- Sharp Incisal Tip
- Height Difference (Anterior)
Follow the formula of applicable wall thickness.

1) Do not make a sharp cut to adjust connector cross section by using a diamond disc as the disc creates sharp notches that may lead to cracks and imminent bridge failure.

2) UTML and STML are not suitable for a cantilevered pontic bridge.

3) ML and HT are limited to 2 pontics within a bridge. When 2 pontics connect, the cross section should be 12mm$^2$ or more. The cantilevered pontic is limited to 1 and cross section should be 12mm$^2$ or more.

Follow the sintering schedule. After sintering adjust inside of the framework and margin.

1) Be sure that material is fully cooled to avoid cracking.

2) UTML and STML flexural strength are not as strong as ML and HT, therefore need special attention like not using excess force or work under running water for inside and/or margin adjustment.

3) Use “Crack Finder” after adjustment to make sure no cracking occurred.

5 Sintering and Adjusting

Follow the sintering schedule. After sintering adjust inside of the framework and margin.

1) Be sure that material is fully cooled to avoid cracking.

2) UTML and STML flexural strength are not as strong as ML and HT, therefore need special attention like not using excess force or work under running water for inside and/or margin adjustment.

3) Use “Crack Finder” after adjustment to make sure no cracking occurred.

Sintering Program Setting

<table>
<thead>
<tr>
<th></th>
<th>UTML</th>
<th>STML</th>
<th>ML &amp; HT</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Temperature</td>
<td>1550°C / 2822°F</td>
<td>1500°C / 2732°F</td>
<td></td>
</tr>
<tr>
<td>Hold Time</td>
<td>2 hours</td>
<td>2 hours</td>
<td></td>
</tr>
<tr>
<td>Rate of Temperature Increase</td>
<td>10°C / 18°F minute</td>
<td>10°C / 18°F minute</td>
<td></td>
</tr>
<tr>
<td>Rate of Temperature Decrease</td>
<td>-10°C / -18°F minute</td>
<td>-10°C / -18°F minute</td>
<td></td>
</tr>
</tbody>
</table>

Compatible Materials

Cerabien™ ZR
FL Glaze, VC Glaze, External Stain, Internal Stain, Luster, etc.

CZR Press LF
LF External Stain, LF Internal Stain, LF Luster, etc.

Warning: Do not mix Cerabien™ ZR and CZR Press LF powder for build-up. Do not use CZR Press (H-ingot, L-ingot, Esthetic White Ingot) for UTML and STML.

Crucial technical points of finishing

1) Polish contact area with opposing tooth and clean restoration by using an ultrasonic cleaner for maximum benefits.

2) After sintering and adjustment, clean restoration thoroughly.

3) When glazing, staining and sintering porcelain always use a stand-pin. Sintering schedules vary per product, therefore review technical instructions.

4) Do not fabricate until cool down to avoid potential cracking.

5) Select the shade number that corresponds to abutment color and according to KATANA™ Zirconia.
The multi-layered zirconia is designed to achieve esthetic results by using glaze method at final process.

Glazing method

1. Create a surface texture over the entire crown under running water or wet condition.
2. Polish areas in contact with opposing tooth. For polishing only finish complete entire crown with polishing.
3. Alumina sandblast surface of the crown (50~70μm, 30psi, 0.2MPa)
4. Clean restoration using an ultrasonic cleaner in alcohol or acetone, or steam cleaner.
5. Apply glaze, bake, complete*

Glazing Method: Select A, B or C method according to the material

<table>
<thead>
<tr>
<th>No.</th>
<th>Product</th>
<th>Dry-out Time min.</th>
<th>Low Temperature °C/°F</th>
<th>Start Vacuum °C/°F</th>
<th>Heat Rate °C/°F min.</th>
<th>Vacuum Level kPa</th>
<th>Release Vacuum °C/°F</th>
<th>Hold Time in the air min.</th>
<th>High Temperature °C/°F</th>
<th>Cooling Time min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CZR Press Glaze</td>
<td>5</td>
<td>600/1112</td>
<td>600/1112</td>
<td>65/117</td>
<td>96</td>
<td>850/1562</td>
<td>1</td>
<td>850/1562</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>Cerabien™ ZR FL Glaze, VC Glaze</td>
<td>5</td>
<td>600/1112</td>
<td>600/1112</td>
<td>65/117</td>
<td>96</td>
<td>850/1562</td>
<td>1</td>
<td>850/1562</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>CZR Press LF Glaze</td>
<td>5</td>
<td>600/1112</td>
<td>600/1112</td>
<td>45/81</td>
<td>96</td>
<td>800/1472</td>
<td>1</td>
<td>840/1544</td>
<td>4</td>
</tr>
</tbody>
</table>

Mix Glaze and External Stain Method: Select A, B or C method according to the glaze material (or choice of glaze)

<table>
<thead>
<tr>
<th>Glaze Material</th>
<th>Baking Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZR Press Glaze + Cerabien™ ZR External Stain Blue, Gray, A+, etc.</td>
<td>Baking Schedule A</td>
</tr>
<tr>
<td>Cerabien™ ZR FL Glaze, VC Glaze + Cerabien™ ZR External Stain Blue, Gray, A+, etc.</td>
<td>Baking Schedule B</td>
</tr>
<tr>
<td>CZR Press LF Glaze + CZR Press LF External Stain Blue, Gray, A+, etc.</td>
<td>Baking Schedule C</td>
</tr>
</tbody>
</table>
After glazing, applied staining will enhance translucent appearance. The UTML enamel shades have reduced chroma in the upper layer which allows you to enhance the translucency appearance of the incisal area, as desired, by utilizing external stain characterization.

### Technical Points of Staining

1) In addition to the feature of horizontal gradation of the multi-layered disc, applying stain with a vertical direction will create three-dimensional appearance.

2) Apply Gray, Blue on the incisal edge area, and A+, B+, C+, D+, etc. on the mamelon area to enhance internal texture and translucency.

#### Example of External Stain

- **Blue: Gray= 1:1**
  - Apply stains to create shadows of mamelon characterizations
- **A+, B+, C+, D+, etc.**
  - Apply external stain horizontally for adjusting chroma
  - Apply external stain vertically to show internal texture characterization

#### Glazing Process

Process glazing on zirconia surface using page 7 “Glazing” method.

1. Apply external stain over glazed surface
2. Bake (under schedule D or E), completion

#### External Stain: Select D or E according to the material

<table>
<thead>
<tr>
<th>No.</th>
<th>Product</th>
<th>Dry-out Time (min.)</th>
<th>Low Temperature (°C/°F)</th>
<th>Start Vacuum (°C/F)</th>
<th>Heat Rate (°C/F min.)</th>
<th>Vacuum Level (kPa)</th>
<th>Release Vacuum (°C/F)</th>
<th>Hold Time in the air (min.)</th>
<th>High Temperature (°C/F)</th>
<th>Cooling Time (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td><strong>Cerabien® ZR</strong> External Stain Blue, Gray, A+, etc.</td>
<td>5</td>
<td>600/1112</td>
<td>–</td>
<td>50/90</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>850/1562</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td><strong>CZR Press LF</strong> LF External Stain Blue, Gray, A+, etc.</td>
<td>5</td>
<td>600/1112</td>
<td>–</td>
<td>45/81</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>840/1544</td>
<td>4</td>
</tr>
</tbody>
</table>
Higher esthetic appearance will be created by layering Luster porcelain over zirconia.

**Technical Points of Build-up**

1) For UTML/STML, it is crucial to secure the minimum wall thickness as recommended on page 5 “Framework Design and Milling Process”, and apply only one layer on the incisal part.
2) Polishing finish on lingual side is recommended.

**Fabrication Process**

Select layering material: either Cerabien™ ZR or CZR Press LF.

1. Create mamelon structure under running water or wet condition.
2. Determine build-up and zirconia thickness.
3. Polish areas in contact with opposing tooth.
4. Perform Almina sandblast on the surface of the unpolished area of the crown (50~70μm, 30psi).
5. Clean restoration using an ultrasonic cleaner in alcohol or acetone, or steam cleaner.
6. Apply wash, then bake*1 (schedule F).
7. Apply internal stain, then bake (schedule G).
8. Porcelain build-up, then bake (schedule H).
9. Perform morphological correction and smooth surface.
10. Apply glaze, external stain, then bake, complete*2.

*1 In case there is not enough build-up space, internal stain can be used during wash baking (schedule F), and be sure to cover entire build-up surface with internal stain.

*2 The surface without porcelain build-up (for example lingual side) is recommended polishing finish.

For glazing, external stain and baking on the non build-up surface of Cerabien™ ZR material it is crucial to follow methods of page 7 “Glazing” step 5 and page 8 “Glaze & Stain Method” steps 1 and 2.
### Cerabien® ZR Baking Schedule

<table>
<thead>
<tr>
<th>No.</th>
<th>Step</th>
<th>Dry-out Time min.</th>
<th>Low Temperature °C/°F</th>
<th>Start Vacuum °C/°F</th>
<th>Heat Rate °C/°F min.</th>
<th>Vacuum Level kPa</th>
<th>Release Vacuum °C/°F</th>
<th>Hold Time in the air min.</th>
<th>High Temperature °C/°F</th>
<th>Cooling Time min.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Wash Baking</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>F</strong> Wash Baking during Internal Stain</td>
<td>5</td>
<td>600/1112</td>
<td>600/1112</td>
<td>45/81</td>
<td>96</td>
<td>930/1706</td>
<td>1</td>
<td>930/1706</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>G</strong> Internal Stain*</td>
<td>5</td>
<td>600/1112</td>
<td>–</td>
<td>50/90</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>900/1652</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>H</strong> Translucent Luster, etc.</td>
<td>7</td>
<td>600/1112</td>
<td>600/1112</td>
<td>45/81</td>
<td>96</td>
<td>930/1706</td>
<td>1</td>
<td>930/1706</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>I</strong> External Stain Glaze, Blue, Gray, A+, etc.</td>
<td>5</td>
<td>600/1112</td>
<td>–</td>
<td>45/81</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>930/1706</td>
<td>4</td>
</tr>
</tbody>
</table>

*Can be eliminated if a wash coat baking was performed during the internal stain process.

### CZR Press LF Baking Schedule

<table>
<thead>
<tr>
<th>No.</th>
<th>Step</th>
<th>Dry-out Time min.</th>
<th>Low Temperature °C/°F</th>
<th>Start Vacuum °C/°F</th>
<th>Heat Rate °C/°F min.</th>
<th>Vacuum Level kPa</th>
<th>Release Vacuum °C/°F</th>
<th>Hold Time in the air min.</th>
<th>High Temperature °C/°F</th>
<th>Cooling Time min.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wash Baking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>F</strong> Wash Baking during LF Internal Stain</td>
<td>5</td>
<td>600/1112</td>
<td>600/1112</td>
<td>45/81</td>
<td>96</td>
<td>840/1544</td>
<td>1</td>
<td>840/1544</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>G</strong> LF Internal Stain*</td>
<td>5</td>
<td>600/1112</td>
<td>–</td>
<td>45/81</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>840/1544</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>H</strong> LF Translucent LF Luster, etc.</td>
<td>7</td>
<td>600/1112</td>
<td>600/1112</td>
<td>45/81</td>
<td>96</td>
<td>840/1544</td>
<td>1</td>
<td>840/1544</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>I</strong> LF External Stain Glaze, Blue, Gray, A+, etc.</td>
<td>5</td>
<td>600/1112</td>
<td>–</td>
<td>45/81</td>
<td>–</td>
<td>–</td>
<td>0.5</td>
<td>840/1544</td>
<td>4</td>
</tr>
</tbody>
</table>

*Can be eliminated if a wash coat baking was performed during the LF internal stain process.
If the patient is hypersensitive to Dental Porcelain or any of the other components, this medical product should not be used. Or it should be only used under the strict supervision of the patient's doctor/dentist.

**Contraindications:**
If the patient is hypersensitive to zirconia or any other components, this product should not be used.

**EU Authorized Representative**
Name: Kuraray Europe GmbH
Address: Philipp-Reis-Str. 4, 65795 Hattersheim am Main, Germany

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Miyoshi, Aichi 470-0293, Japan
http://www.kuraraynoritake.com

Read the IFU (Instructions For Use) before the procedure. Printed color may not accurately present actual color.

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