

Perfit FS

Instructions for use

vatech

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1-1. Perfit FS

Perfit FS is a patented*, fully sintered, 100% tetragonal zirconia block for direct machining into inlays, onlays, crowns, and bridges. The exceptional machinability is achieved through higher fracture toughness, lower scratch hardness, and coarse microstructure. Our product delivers unique mechanical properties and micro-structures that permit machinability in a fully sintered state using high speed diamond burs. Further advantages of Perfit FS include higher translucency and excellent resistance to low temperature degradation.

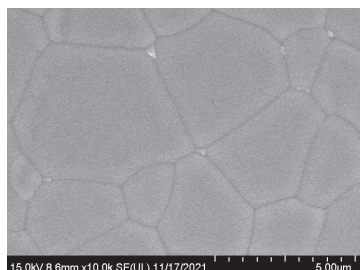
Frameworks milled using Perfit FS do not require a sintering step, and as a result, the preparation time is reduced dramatically while the marginal fit is improved with no shrinkage involved in the fabrication step of the restorations. Perfit FS can be milled into a single crown with CAD/CAM wet milling machines.

Monolithic restorations can be produced chairside by the dentist. Dental clinics may utilize Perfit FS blocks to offer full contour zirconia restorations in a “single visit.” The blocks allow the fabrication of esthetic restorations without the need for further build-up techniques.

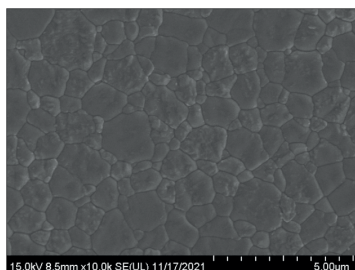
1-2. Key feature

1) Microstructures

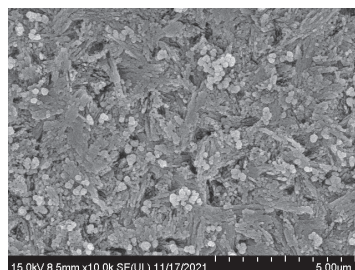
The grain size of Perfit FS is about $4.0\ \mu\text{m}$ which is nearly 4 times greater than that of 5 mol% Y_2O_3 stabilized ZrO_2 , 5Y-TZP. The coarse microstructure combined with exceptional fracture toughness and low scratch hardness confers superior machinability. Grinding is possible with a general wet milling machines due to its unique particle structure.



Perfit FS



5Y-TZP

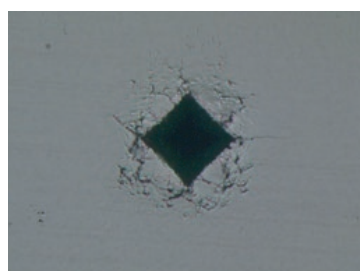


Glass Ceramic

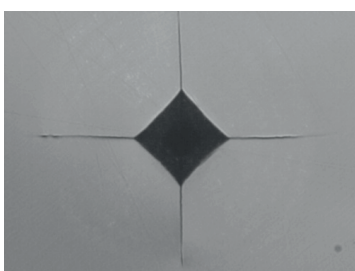
2) High level of crack resistance

Compared to conventional 5Y-TZP zirconia and Glass Ceramic, Perfit FS shows no apparent cracks emanating from the corners of the diamond indentation, indicating its exceptional fracture toughness. In conclusion, restorations of Perfit FS have greater crack resistance than other types of restorations shown below.

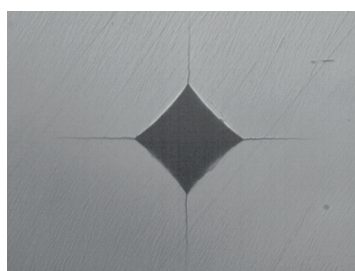
After Vickers indentation at 10 kg load



Perfit FS



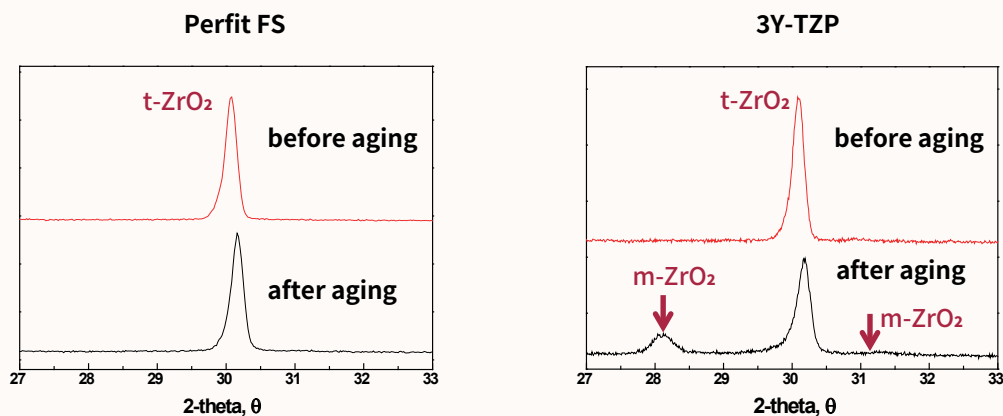
5Y-TZP



Glass Ceramic

The low temperature degradation, LTD or aging, is defined as spontaneous tetragonal-to-monoclinic transformation occurring over time at low temperatures. The degradation represents thermodynamic stability, and lower transformation means less microcrack occurrence and decrease in strength. While 21% of the tetragonal phase transformed to monoclinic for 3Y-TZP after aging for 5 h at 132°C and 0.2 MPa, ISO13356 standard, no degradation occurred on Perfit FS under identical conditions.

Low temperature degradation



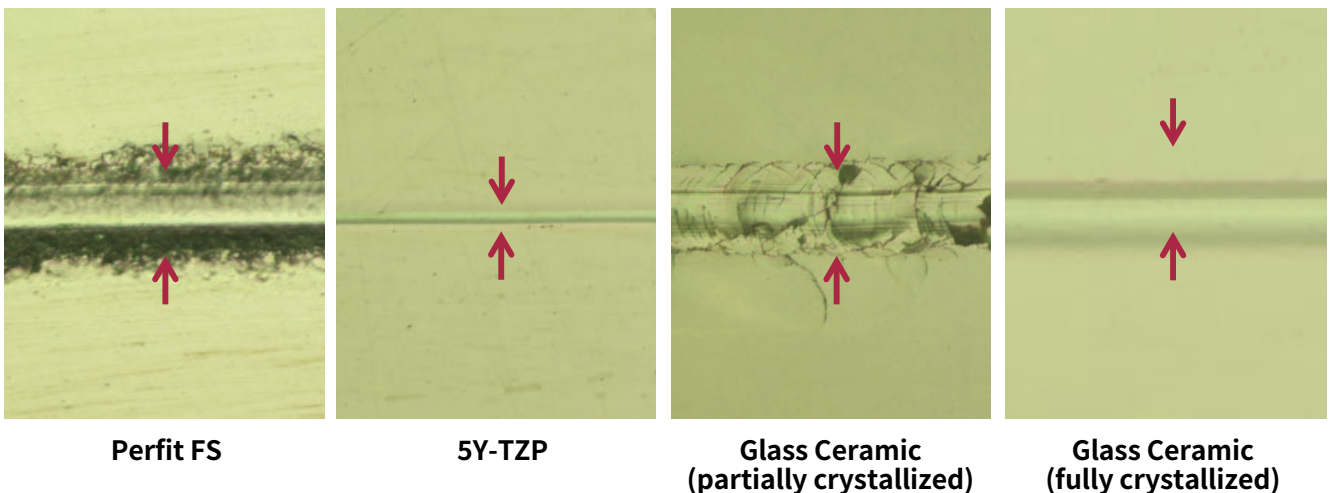
3) Perfit FS Machinability

Addition of special inorganic material

The special inorganic material added to Perfit FS zirconia powder dramatically increases machinability by reduction the hardness of the block, so Perfit FS can be processed with a general 4-axis and 5-axis wet milling machine. In addition, it prevents stress cracking rate by improving the fracture toughness.

Mechanical properties

Scratch grooves formed by diamond indenter at 5 kg



Properties	Perfit FS (A2)	5Y-TZP (Zirconia)	Glass Ceramic after crystallization	Glass Ceramic before crystallization
3-point bending strength, MPa	500	800	364	236
Translucency*, %	46	49	58	12
Fracture toughness, MPa · m ^{1/2}	6.9	2.8	2.1	1.2
Vickers hardness, GPa	8.5	13.0	5.8	5.8
Modulus, GPa	202	220	107	87
Scratch hardness, GPa	16.8	23.4	12.1	9.1

* Vatech Laboratory Self-Measurement

The arrows indicate the groove width of each material scratched at 5 kg load. Perfit FS formed a width of high groove, representing low scratch hardness. The low scratch hardness enables Perfit FS an exceptional machinability, similar to that of (partially crystallized) glass ceramic block. Comparison with other types of restoration, Perfit FS exhibits lower scratch hardness while exhibiting higher fracture toughness. The higher fracture toughness represents higher resistance to crack propagation that suddenly becomes rapid under a stress.

2-1. Technical Data(Properties)

The chart below shows the technical data of the fully sintered block. Vatech doesn't provide sintering schedule as Perfit FS does not require sintering.

* Standard Composition

Material	% by weight (Perfit FS)
Zirconium oxide(ZrO ₂)	80.0 – 90.0
Yttrium oxide(Y ₂ O ₃)	10.0 – 15.0
Niobium pentoxide(Nb ₂ O ₅)	5.0 – 10.0
Other oxides	2.0 – 5.0

* Physical Properties

Property	Result Value
Flexural strength (3-point)	500 MPa
Fracture toughness	6.9 MPa · m ^{1/2}
Vickers hardness	8.5 GPa
Coefficient of Thermal Expansion (CTE)	10.6 x 10 ⁻⁶ /K
Modulus of elasticity	202 GPa
Translucency	46 %
Type / Class (ISO 6872)	2 / 4

Perfit FS A2 reference property

The sample size

- Flexural strength : 3 x 4 x 45 mm³
- Translucency : 1.0 mm Thickness

Evaluation Method

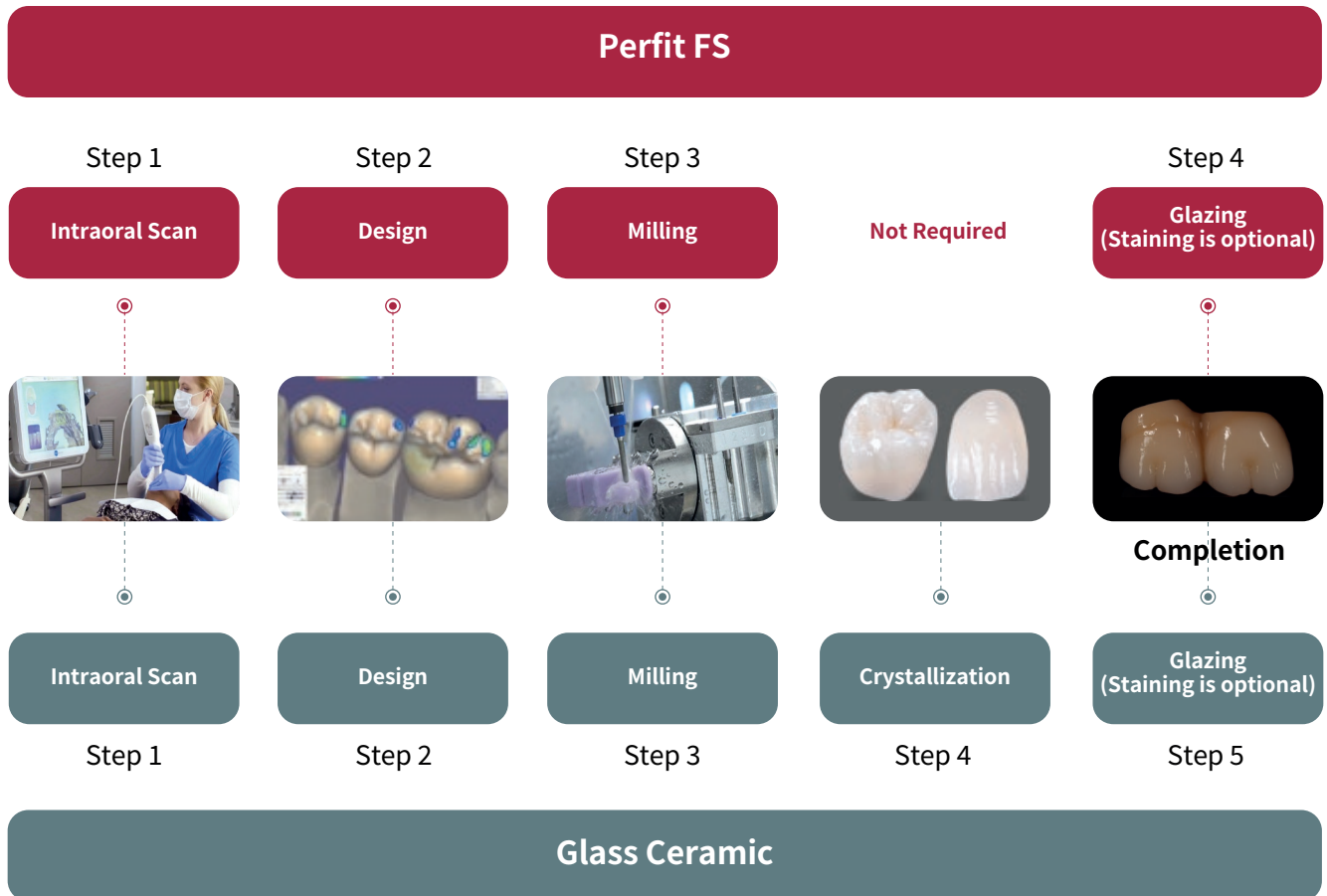
- Flexural strength : ISO 6872:2015(E)

Key Source

- Vatech Laboratory

2-2. Workflow

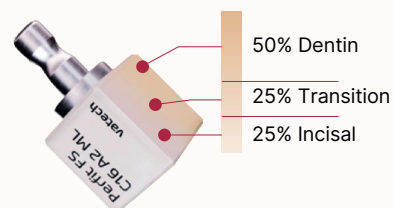
Perfit FS is a fully sintered zirconia block, and does not need sintering and firing processes after milling. This is advantageous in creating restorations quickly compared to other chairside blocks. Please refer to the below workflow.



3-1. Block Selection



Pre-shaded



Multi Layered Block

Perfit FS lineup consists of a pre-shaded block and a multi layered block. The user may choose the right types of block by considering its indications and details of the restoration. Pre-shaded block is categorized into dentin shades. Its indications include inlay/onlay, coping, crown and 3-unit bridge. With matching dentin shade, the pre-shaded block results in ideal restoration outcome.

The multi layered block is used in cases that require detailed shade expression. Indications include crown and 3-unit bridge. The sizes of I10 and I12 are not provided in a multilayered block, due to nesting difficulty.

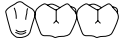
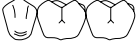


1) Indications for use

Refer to indications for use shown below.

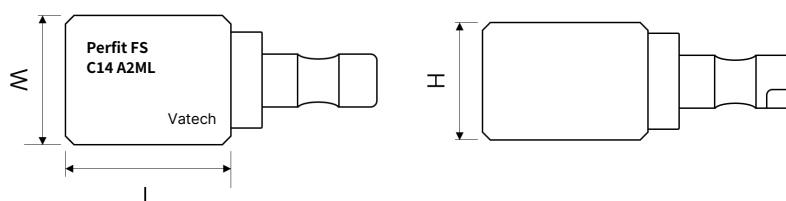
Perfit FS (Pre-Shaded Block)

Perfit FS (Multilayered Block)

Perfit FS (I10) Perfit FS (I12)	 Inlay / Onlay	Perfit FS (C14) Perfit FS (C16)	 Single Crown (Anterior)	 Single Crown (Posterior)
Perfit FS (C14) Perfit FS (C16)	 Single Crown (Anterior)	 Single Crown (Posterior)	 Coping	
Perfit FS (B32)	 Full Contour Bridge (up to 3 units)	Perfit FS (B32)	 Full Contour Bridge (up to 3 units)	

2) Geometry

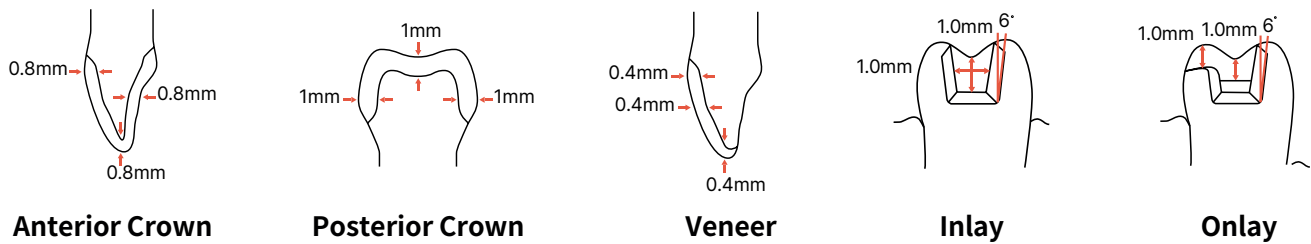
There are five types of sizes in Perfit FS, and user may select blocks according to the length of the crown. It means Inlay/Onlay, C means Crown, and B means Bridge. Please refer to block sizes below.



	L(mm)	W(mm)	H(mm)
I 10	15	10	8
I 12	15	12	10.4
C 14	18	14	12.7
C 16	18	15.9	17.8
B 32	32	15.1	15.1



3-2. Minimum Wall Thickness



Minimum Wall Thickness is the most important factor to consider to avoid crack in the patient's mouth. The minimum wall thickness is different depending on the indications, so please refer to the picture above and the table below.

In the anterior case, the masticatory force is not strong, so the minimum wall thickness may be relatively thin compared to the posterior case.

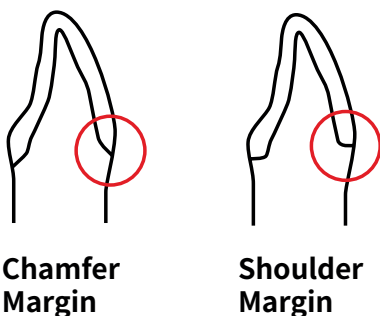
For bridge case, the connector dimensions should follow the guide below.

If an abutment shade shows dark stump, the minimum wall thickness should be more than 1 mm.

	Anterior		Posterior	
	Minimum Thickness(mm)	Connector Dimensions(mm)	Minimum Thickness(mm)	Connector Dimensions(mm)
Inlay/Onlay			1.0	
Veneer	0.4			
Crown	0.8		1.0	
3-unit Bridge	1.0	12	1.0	16

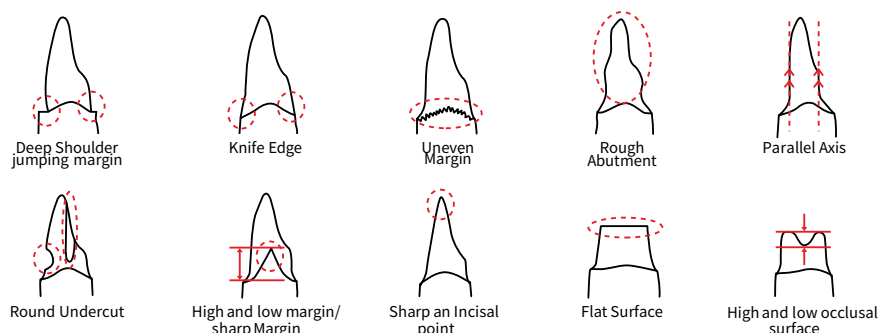
3-3. Prep Guide

To prevent misfit, tooth preparation should be properly executed to integrate the restoration and the abutment surface.



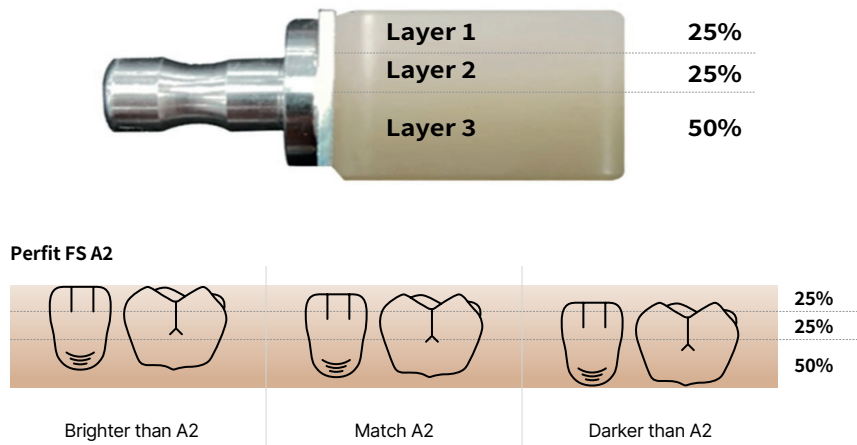
- The Tooth Preparation surface should not be angled or sharp.
- Chamfer Margin or Shoulder Margin is recommended.
- Chamfer Margin has a curve slope and brings unique distribution of stress are suitable.
- Shoulder Margin gives sufficient space for restorations production.
- Please refer to the minimum wall thickness for tooth preparation.
- Smooth the preparation surface and do not form undercut.
- Complete the angle point with a curved surface; abutment should not be sharp or angled.
- Ensure that the thickness of the dental restoration is uniform.
- Round the line angle to avoid stress.

* Contraindication



3-4. Positioning Instruction

Positioning multilayered zirconia block is important in order to express right shade and translucency using CAM S/W. Optimal translucency and shade are possible if the incisal zone, the intermediate zone, and the body zone are adjusted with the heights of crown and bridges accordingly.



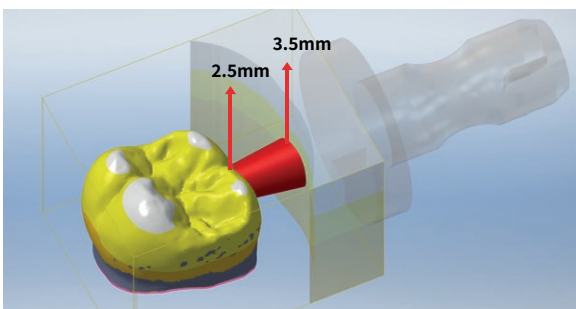
Perfit FS Multilayer block consists of a three-layers, Dentin Zone 50%, Intermediate Zone 25%, and Incisal Zone 25%. Refer to the image above for optimal results.

3-5. Milling Strategy

Refer to the milling strategy below to select a milling machine type that is compatible with Perfit FS. Before using Perfit FS, technical support requires users to check the milling machines to be compatible with the milling strategy including the tool and CAM system.

* Milling Information

Processing	Production Method	Axis	Mandrel Type
Grinding	Wet Type	4 or 5	Universal Type (or CEREC mandrel type)



- 4-axis or 5-axis wet type milling machine that can mill glass ceramic blocks.
- A milling machine operating at a spindle speed of >60,000 rpm in wet environment.
- The use of grinding tool (diamond electroplated tool) is mandatory.
- Diamond plated tools are required throughout the restoration processes including milling and finishing.
- Pin diameter of 2.5mm at crown and diameter of 3.5mm at material is recommended.

* Material Selection

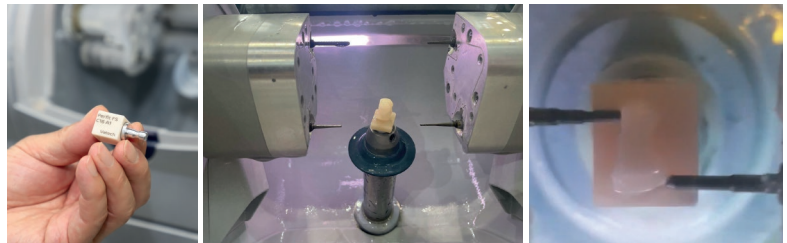
For material selection in CAM S/W, Select IPS e.max CAD except for the below scenarios.

CEREC MC XL, inLab MC XL(Dentsply Sirona)

CEREC Software version	Selection
CEREC v4.2 or above	Celtra Duo
CEREC v4.2 or below	IPS e.max CAD (e.max CAD standard grinding)

* Milling Process

1. Attach the block to the machine.
2. Enter the size information of the block.
3. Input the information required for machining.
4. Check the inflow of grinding coolant.
5. Be sure to spray the coolant while the block is processing.
6. Remove the finished block.



3-6. Finishing

When separating the sprue, use a disc, wheel, and a carbide point with low speed and low pressure. Utilize a rough bur first; then a soft bur to make the surface more natural. Be careful when handling a thin margin.



1 Separate the sprue from the incisal using Diamond disc (heatless product recommended) for zirconia.



2 Remove the sprue with stone wheel for zirconia.



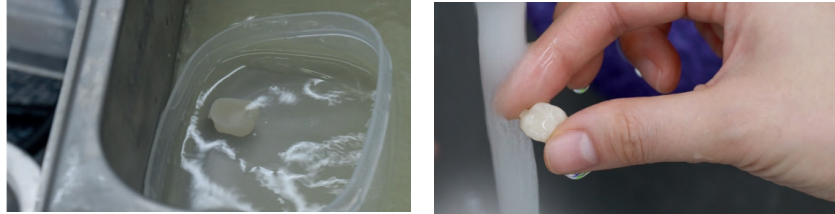
3 Surface Trim with Silicon Carbide Point for 1st Polishing.



4 To remove the oil film generated on the surface during milling, Use ultrasonic cleaner for one minute.

3-7. Ultrasonic Cleaning

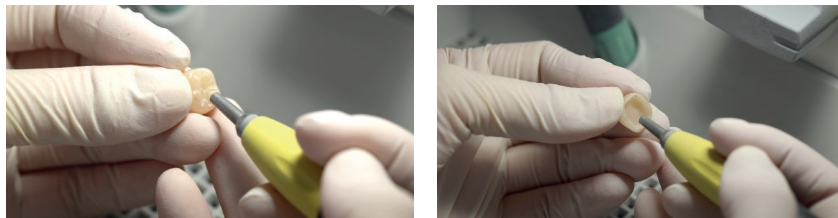
An ultrasonic cleaner should be utilized to remove the oil film on the surface generated during milling. Staining and glazing paste does not adhere well without removing the oil film.



Put Isopropyl alcohol (IPA, 70% alcohol) in a container and soak the restoration to be cleaned. Place container in ultrasonic cleaner and wash for 1 minute. Wash and dry with clean water.

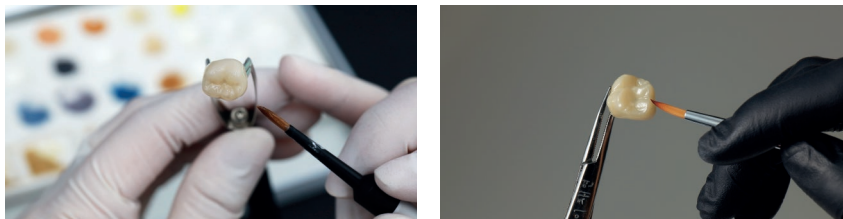
3-8. Sandblasting(Optional)

Using alumina oxide (Al_2O_3) of 100 μm in particle size, blast at a pressure of 2~4 bar for approximately 15 seconds.



3-9. Glazing(Staining is optional)

After separating the sprue, glazing is applied on the crown (Staining is optional). Most staining and glazing products may be used with a thermal expansion coefficient between 9 and 11. Follow the firing temperature of the glazing manufacturer.



*** High polishing is not recommended as it can decrease aesthetic.**

3-10 . Cementation

The types of cement recommendation for zirconia restoration are RMGI and self-adhesive resin cement.



- **RMGI(Resin Modified Glass Ionomer) Type :**
Crown & Bridge (not recommended for Inlay/Onlay due to aesthetic)
- **Resin Type :** Inlay/Onlay, Crown & Bridge

FAQ

Material

1. What is the unique about Perfit FS(fully sintered zirconia)?

The special inorganic material added to Perfit FS zirconia powder dramatically increases machinability by reduction the hardness of the block.

The load test shows scratch grooves formed by indentation load is similar to glass ceramic (partially crystallized) block.

2. Does Perfit FS have multilayered blocks? If so, What is the rate of layers?

Layer 1(25%), Layer 2(25%), Layer 3(50%) from incisal(top) to cervical(bottom).

3. Do you provide a block for abutment solutions?

No, we do not provide abutment solutions..

Milling

1. Which milling machines are compatible?

4-axis or 5-axis wet type milling machines that can mill glass ceramic blocks.

* Before using Perfit FS, technical support requires users to check the milling machines to be compatible with the milling strategy including the tool and CAM system.

* Tested Milling Machine

- CORiTEC one, CORiTEC one+, CORiTEC 150i Pro, CORiTEC 350i series (imes-icore)
- CEREC MC XL, CEREC MC X, PrimeMill (Dentsply Sirona)
- DWX-42W (Roland DG)

2. What kind of a milling tool(Bur) should be used?

The use of grinding tool (Diamond electroplated tool) is mandatory, and the grinding tool life may depend on the characteristics of the manufacturer.

3. Which a material should I select in CAM S/W?

- CEREC MC XL, inLab MC XL (Dentsply Sirona)

CEREC Software version	Selection
CEREC v4.2 or above	Celtra Duo
CEREC v4.2 or below	IPS e.max CAD (e.max CAD standard grinding)

Finishing

1. Is it possible to build up on the surface of Perfit FS?

Yes, the users may build up on the surface of Perfit FS.

2. Is it possible to apply opaque solution on the surface of Perfit FS?

Applying opaque coloring or paste on fully sintered zirconia is very difficult and deemed infeasible. Although there are opaque powders, it is not recommended.

3. Is it necessary to etch inner surface?

No, etching is not necessary for Perfit FS.

4. What types of a cementation is used?

The recommended cementations for zirconia restoration are RMGI and self-adhesive resin cement.

• RMGI(Resin Modified Glass Ionomer) Type :

Crown & Bridge (not recommended for Inlay/Onlay due to aesthetic)

• Resin Type : Inlay/Onlay, Crown & Bridge

5. Is it possible to polish the surface of Perfit FS?

High gloss polishing is not recommended as it can decrease the strength and aesthetic compared to glazing. High gloss polishing on anterior may be used if necessary.

6. Is it possible to use stains and glaze paste regardless of manufacturers?

Stains and glaze are related to CTE (Coefficient of Thermal Expansion).

The CTE value of Perfit FS is $10.6 \times 10^{-6}/K$.

We recommend any stains & glaze products that are close to the CTE value of Perfit FS.



