P5-6

The mechanical and microstructural properties of self-glazed zirconia

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BACKGROUND

Monolithic zirconia crowns are widely used in prosthodontic treatment. Recently, self-glazed zirconia (SGZ), which is manufactured by additive 3D gel deposition approach, has been developed[1]. However, there is little scientific information on SGZ.

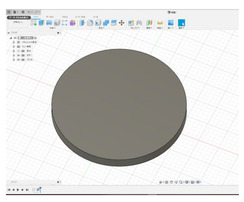
The aim of the present study was to analyze the mechanical and microstructural properties of SGZ.

Self-glazed zirconia crown[2] [3]

MATERIALS AND METHODS

Test: Self-Glazed Zirconia (SGZ)

(Hangzhou Erran Technology, Hangzhou, China)



Precision additive 3D gel deposition

Final sintering

Designed in the CAD software

ϕ 15.6 mm, thickness 1.3 mm

Control: Lava Plus Zirconia (3M, St. Paul, MN, USA)

➡Conventional dental zirconia stabilized with 3 mol% yttria

- **Chemical composition** n=3
  Wavelength-dispersive X-ray fluorescence (WDXRF) analysis
- **Flexural strength** n=15
  Biaxial flexural strength test
  ISO 6872:2015
- **Grain size**
  Scanning electron microscopy (SEM)
- **Crystalline structure** n=3
  X-ray diffraction (XRD) analysis

RESULTS

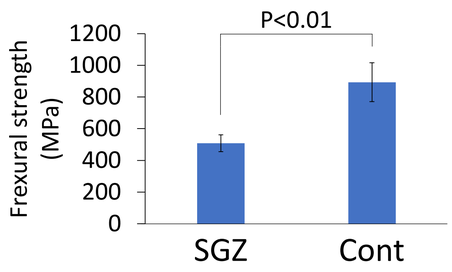
Chemical composition

mol%

		ZrO_2	Y_2O_3	HfO_2	Al_2O_3
SGZ	Ave	95.42	**3.29**	1.17	0.13
	SD	0.13	0.09	0.09	0.06
Cont	Ave	95.41	**3.34**	1.13	0.12
	SD	0.10	0.04	0.06	0.02

SGZ contained yttria at almost the same concentration as the Cont zirconia.

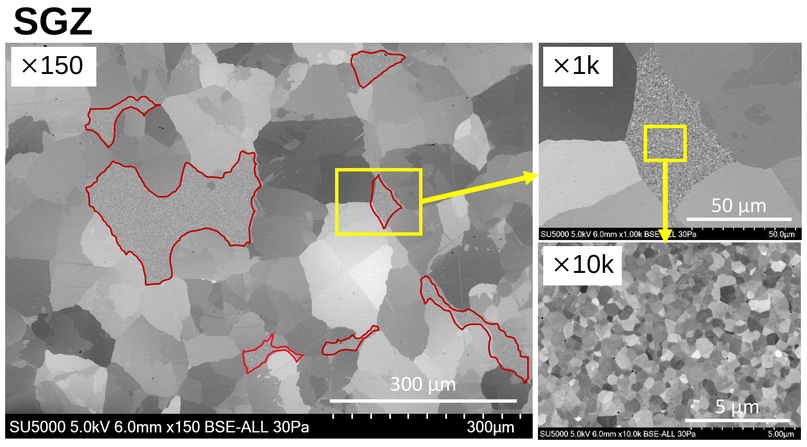
Flexural strength



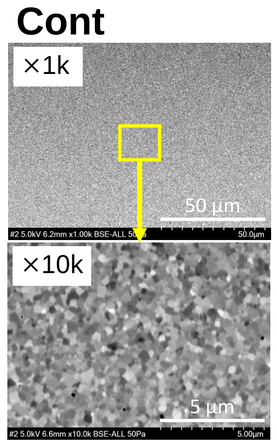
The mean flexural strength of SGZ was lower than that of the Cont zirconia.

Grain size

SGZ



Cont



The area enclosed with red line contained small grains

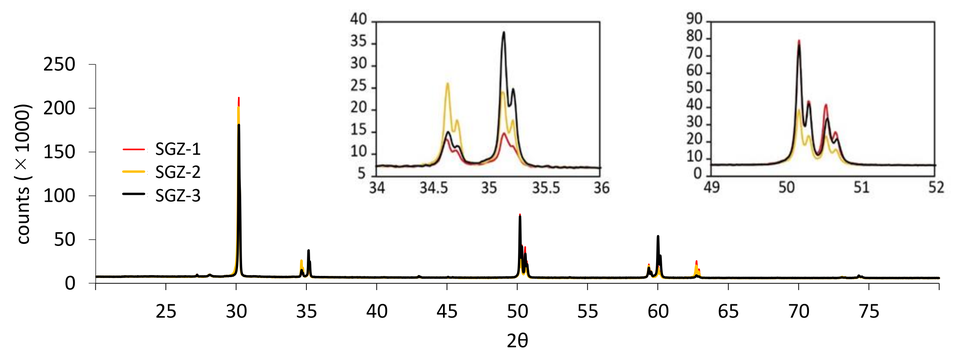
Large 45.94 ± 8.53 μm, Small 0.39 ± 0.01 μm

0.31 ± 0.01 μm

- SGZ contained extremely large grains with gaps filled with small grains.
- The size of small grains was slightly larger than that of the Cont zirconia.

Crystalline structure

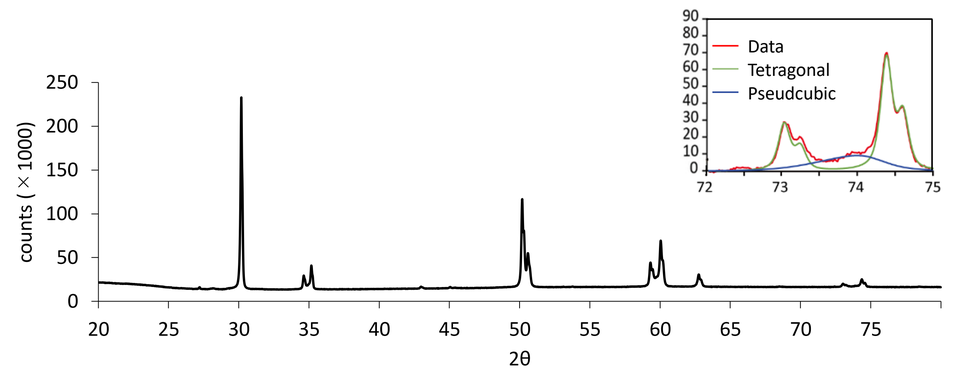
SGZ



Rietveld refinement could not be performed for SGZ .

The peak intensities were varied due to the presence of the large grains.

Cont

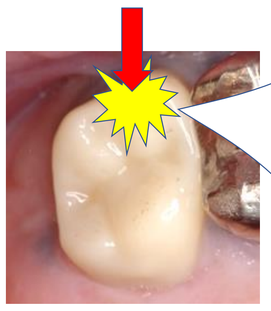


Rietveld analysis revealed that conventional zirconia was composed of **79% tetragonal phase** and **21% pseudocubic phase.**

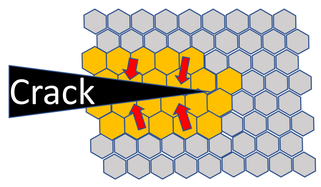
As both materials had the diffraction peaks at the same 2θ angles, **it is reasonable to assume that SGZ was also mainly constituted of tetragonal phase.**

DISCUSSION

Mechanical stress



Conventional zirconia
(Milling)

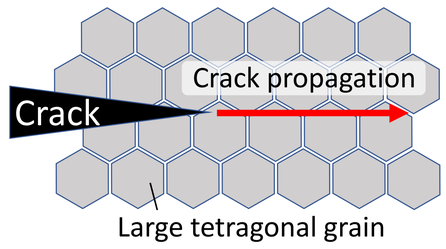


Monoclinic grain Tetragonal grain

Stress-induced phase transformation

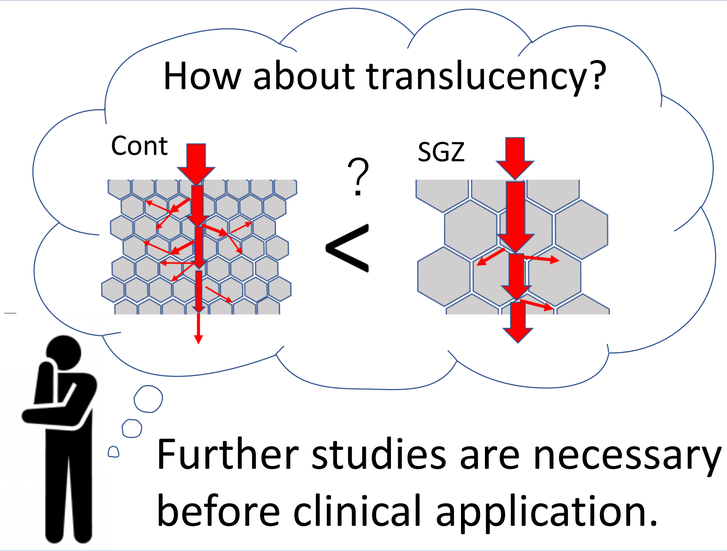
High flexural strength

Self-glazed zirconia
(3D gel deposition)



Lack of phase transformation

Lower flexural strength



Further studies are necessary before clinical application.

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