



Development and evaluation of new extra high translucent zirconia

○M. Yoshinaga, D. Ohta, T. Sato, F. Fusejima, T. Kumagai
GC Corporation, Tokyo, Japan



OBJECTIVES

Since the introduction of CAD / CAM systems in dentistry, zirconia has been attracting attention due to its high mechanical strength and aesthetic property. Recently, application of zirconia in the clinical practice has expanded. The full contour zirconia crown has become a major prosthetic restorative. However, there is a demand for higher translucency clinically. Therefore, a new extra high translucent zirconia was developed. The purpose of this study was to evaluate the transmittance and low temperature degradation resistance of this new material.

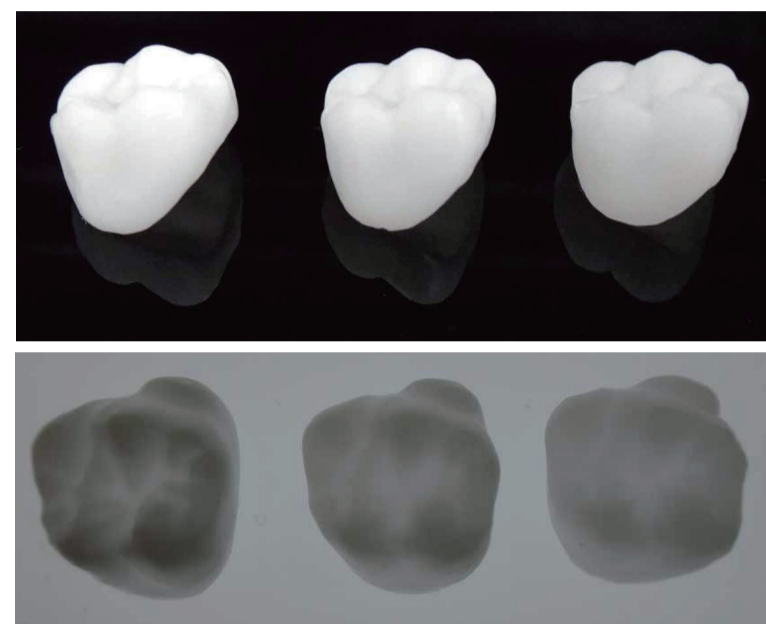
METHODS

Test Methods

Three zirconia materials were selected for analysis. 1) Initial Zirconia ST: conventional type (GC Corp.), 2) Initial Zirconia HT : high translucent type (GC Corp.), and 3) experimental zirconia prototype (extra high translucent type). Specimens were sintered at 1450 °C for 2 hours. A heating rate of 8 °C/min was applied up to 1000 °C and subsequent heating at 2 °C/min up to the sintering temperature.

Total light transmittance of specimen with 0.5mm, 1.0mm, 1.5mm thickness was measured using a Hazemeter.

Accelerated aging of specimen with sintered, mirror-polished was carried out in reference to ISO 13556:2008. Specimens were autoclaved in steam at 134 °C, 0.2 MPa, for 5 hours. X-ray diffraction (XRD) was used to identify the crystal phases of test samples and relative content of monoclinic phase was calculated. The content of monoclinic phase was calculated according to the Garvie-Nicholson method.



ST HT Prototype
Fig.1. Zirconia full contour restoration

Materials

Table.1. Materials

| Sample Name | Type | Manufacture | Lot. No. |
|---------------------|------------------------|-------------|----------|
| Initial Zirconia ST | Conventional | GC | 1404111 |
| Initial Zirconia HT | High translucent | GC | 1304121 |
| Prototype | Extra high translucent | GC | 1405151 |

RESULTS & DISCUSSIONS

Transmittance

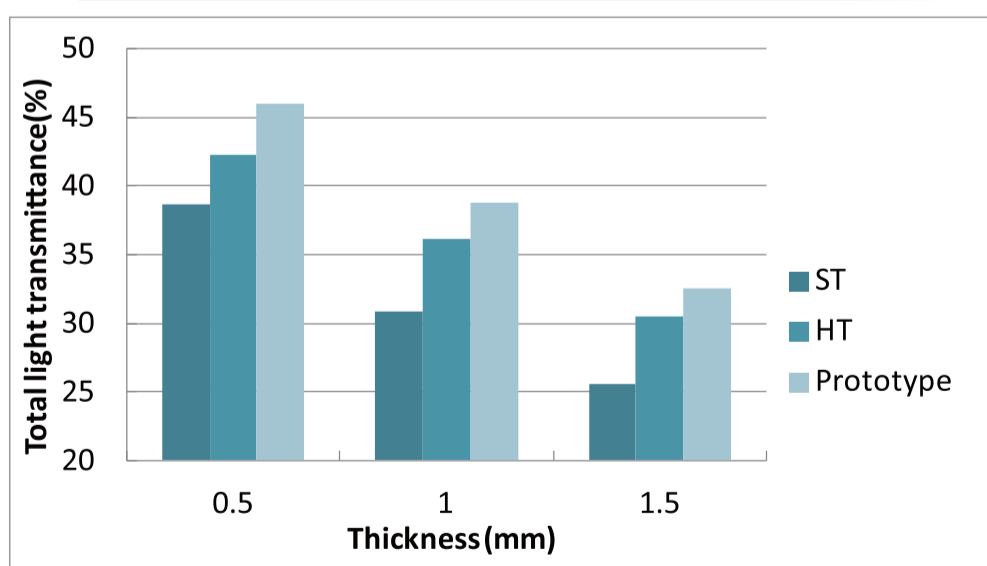


Fig.2. Transmittance Test

The new experimental zirconia exhibited the highest translucency. From the XRD analysis, no monoclinic phase was observed in new zirconia. All the samples had satisfied the ISO 13556:2008. Furthermore, low temperature degradation can be prevented by polishing.

CONCLUSIONS

This study confirmed the highest translucency and the lowest low temperature degradation of newly developed zirconia restorative material. This novel zirconia may be considered as a highly esthetic material for full contour restoration.

Low temperature degradation

Table.2. The amount of monoclinic phase

| Sample Name | Sintered | Polished |
|---------------------|----------|----------|
| Initial Zirconia ST | 13 | 0 |
| Initial Zirconia HT | 14 | 4 |
| Prototype | 0 | 0 |

$$X_m = \frac{I_m^{(\bar{1}11)} + I_m^{(111)}}{I_m^{(\bar{1}11)} + I_m^{(111)} + I_t^{(101)}}$$

X_m : content of monoclinic phase
I : intensity of the XRD peaks