# A basic study on the fitness of a zirconia keeper coping fabricated by CAM system

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#### Abstract

The purpose of this study was to evaluate the fitness of a zirconia keeper coping fabricated by CAM system (Cercon<sup>®</sup> brain, DeguDent).

Specimens made of a semi-sintered zirconia block (Cercon<sup>®</sup> base, DeguDent). Fitting accuracy was evaluated by a cement-replica technique with silicone materials. For the keeper coping specimens, the mean fitting gaps were  $0.23 \pm 0.08$  mm at the finish line of coping,  $0.26 \pm 0.04$  mm at the interface between the coping and post, and  $0.32 \pm 0.06$  mm at the tip of the post. This study found that the adaptation of a zirconia keeper coping fabricated by this system was not recommended.

## Introduction

The dental CAM system and CAD/CAM system has been used generally to fabricate a various prosthesis in clinical dentistry. However, the keeper coping of magnetic attachment was still cast by a lost wax method used in dental casting. In the past, although manufacturing method of keeper coping using the dental CAD/CAM system by "scanning probe" has been reported<sup>1</sup>, it has not been usually used.

Recently, the dental CAM system and CAD/CAM system by "laser scanning" has been primarily used because of high-precision performance, and zirconia ceramics has become popular materials in a clinical dentistry. Zirconia ceramics has excellent mechanical strength for prosthetic appliances and biocompatibility with a significant reduction in plaque<sup>2</sup>. Those facts suggest that zirconia ceramics were clinically useful for keeper coping of magnetic attachment.

The purpose of this study was to evaluate the fitness of a zirconia keeper coping fabricated by the dental CAM system by laser scanning.

# **Materials and Methods**

*Materials:* The prepared epoxy resin tooth at lower canine (338: NISSIN) was selected as the abutment tooth of keeper coping with a root canal length of 5 mm. The keeper coping was fabricated using the dental CAM system (Cercon<sup>®</sup> brain, DeguDent), and a semi-sintered zirconia block (Cercon<sup>®</sup> base, DeguDent) was employed for the keeper coping material (Table.1).

Fig.1 shows the wax pattern used for scanning and the zirconia keeper coping fabricated by this CAM system.

Puroduct	Composition
Cercon <sup>®</sup> base	ZrO <sub>2</sub> 89.2%
	Y <sub>2</sub> O <sub>3</sub> 5.0%
	HfO <sub>2</sub> 5.0%
	other oxides

Table.1 Material composition in this study



Fig.1 Keeper coping specimens in this study (a: Wax pattern b: Zirconia keeper coping)

*Methods (Cement-replica technique)*: The fitting accuracy was evaluated using a cement-replica technique. Each keeper coping was placed in the master die with a white silicone material (FIT CHECKER ADVANCED, GC). After curing a white silicone material, the keeper coping with a white silicone material is removed from the master die. Then, the keeper coping with it was embedded in a blue silicone material (EXAMIXFINE Regular Type, GC). The keeper coping was demounted from the cured silicone material, and a blue silicone material filled in the space (Fig.3).



Fig.3 Fabrication procedure of specimens (Cement-replica technique)

*Determination of fitting accuracy*: Each silicone replica specimens were sectioned in the buccolingual direction through the center of the coronal root (Fig.4). The measuring points of the white silicone layers are shown in Fig.5. The maximum value was picked up from the range of each part.



Fig.4 Section of silicone replica specimen in the buccolingual direction



Fig.5 Measuring points (a: Finish line of coping b: Interface between coping and post c: Tip of post)

## Results

The mean thicknesses of the white silicone layers, namely the mean fitting gaps, were  $0.23 \pm 0.08$  mm at the finish line,  $0.26 \pm 0.04$  mm at the interface between the coping and post, and  $0.32 \pm 0.06$  mm at the tip of the post (Fig. 6). There was no significant difference in the mean thicknesses of the white silicone layers between 3 measuring points by one way ANOVA and Tukey–Kramer method (p<0.05).



Fig. 6 The mean thicknesses of the white silicone layers at 3 measuring points

## Conclusion

It was concluded that the fitness of a zirconia keeper coping fabricated by this system was more poor than the fitness of other prosthesis reported in the past (Permissible fitting gap: 0.1~0.15 mm). So the adaptation of a zirconia keeper coping fabricated by this system was not clinically recommended. We will make further refinements to manufacturing method by laser scanning.

## References

- 1. K. Tsuda, Y. Tanaka, T. Kanazawa, M. Sakane, and K. Kumano: Fabrication of a Keeper Coping by use of the CAD/CAM System, J J Mag Dent, 13(1), 9–17, 2004.
- 2. T. Miyazaki, T. Nakamura, H. Matsumura, S. Ban, and T. Kobayashi: Current status of zirconia restoration, J Prosthodont Res, 57, 236–261, 2013.