A pilot study on the fitness of a titanium root coping fabricated by CAM system—Application of a high-precision scanner

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Abstract

In this study, we report on the accuracy of matching titanium root copings fabricated using a high-precision laboratory scanner.

The abutment tooth was a preformed epoxy artificial tooth (A50-359, NISSIN). The manufacturing procedure involves scanning a work model using a laboratory scanner (E3, 3Shape), modeling it using design software (Dental System, 3Shape), and then cutting it with a milling machine (GeoMill ARUM 5X, GeoMedi). Five specimens were tested, and the fitting accuracy of the titanium root coping was evaluated using the cement replica method.

The measurement points are the labial margin at point a, the labial cervix at point b, the labial post at point c, the tip of the post at point d, the lingual post at point e, the lingual cervix at point f, and the lingual margin at point g. The average gaps were 46.4±17.8 μm at point a, 59.6±13.6 μm at point b, 31.6±8.9 μm at point c, 145.7±43.8 μm at point d, 46.4±11.2 μm at point e, 92.7±14.3 μm at point f, and 72.1±37.0 μm at point g.

It was suggested that the titanium root coping manufactured using a high-precision laboratory scanner could be applied clinically.

Introduction

Recent advances in dental CAD/CAM systems have been remarkable, and they are expected to simplify the workflow and improve the fitness of prostheses. At the 32nd Annual Meeting, we examined the accuracy of the fitness of zirconia root copings made by scanning with a technical scanner alone. In this study, we examined the accuracy of the conformity of the root coping fabricated using a titanium disk as a new material for digitalization.

Materials and Methods

The abutment was an epoxy artificial tooth (A50-359, NISSIN) with a post part 5 ㎜ deep, as recommended by JSMAD. As for the manufacturing procedure, after taking an impression according to the standard method, a working model was made, it was scanned using a dental scanner for laboratory use (E3, 3Shape), and it was then scanned using design software (Dental System, 3Shape). After modeling, we cut out titanium disk(DentalBank) using a milling machine(GeoMill ARUM 5X, GeoMedi) (Figs. 1 and 2). The cement space was the specified value of the software, and there were five test samples (Fig. 3).

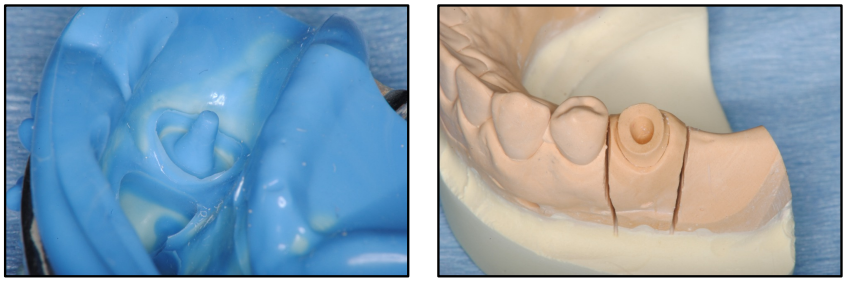

Fig. 1 Impression and working model

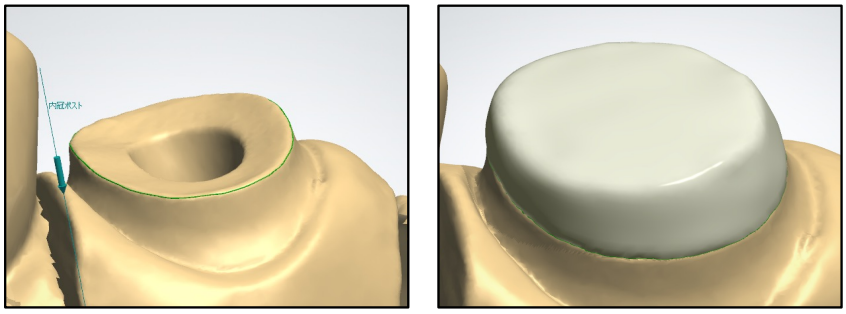

Fig. 2 Scanned model and designed root coping

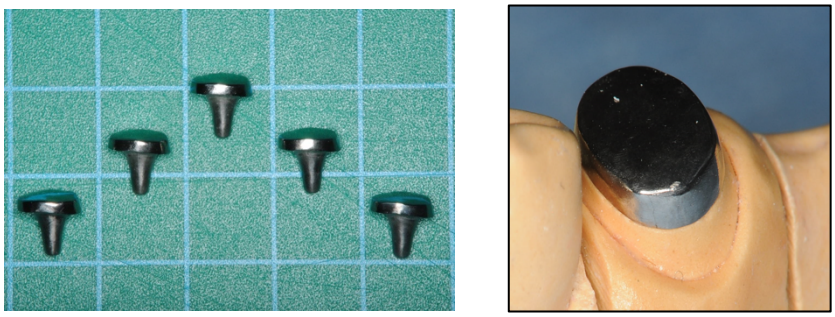

Fig. 3 Fabricated titanium root coping

The fitting accuracy was evaluated using the cement replica method, which quantifies the gap between the model and the root coping based on the thickness of the silicone rubber coating (Fig. 4).

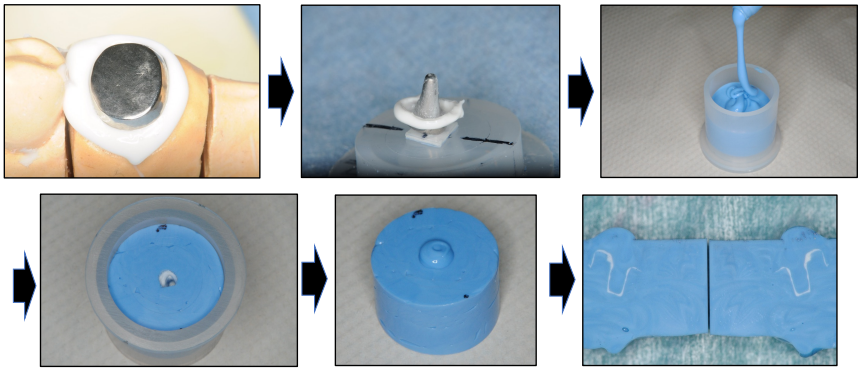

Fig. 4 Fabrication procedure of specimens (Cement-replica technique)

In addition, the gap distance was measured by capturing a digital image of the cut surface of the silicone rubber together with a scale used as a reference and measuring it on a PC. In addition, seven measurement points were set as shown in Fig. 5.

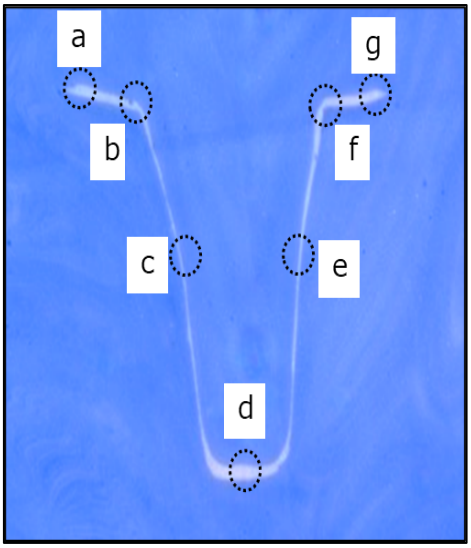

Fig. 5 Measuring points
(a:labial margin b:labial cervical c:labial center of post d: tip of the post
e: lingual center of post f: lingual cervical g: lingual margin)

Results

The average gaps were 46.4±17.8 μm at point a, 59.6±13.6 μm at point b, 31.6±8.9 μm at point c, 145.7±43.8 μm at point d, 46.4±11.2 μm at point e, 92.7±14.3 μm at point f, and 72.1±37.0 μm at point g (Fig. 6). Measurement points a, b, c, e, f, and g showed good compatibility as compared with the allowable range of compatibility for CAD/CAM prostheses reported by Suto et al.,[1] which is 100 μm.

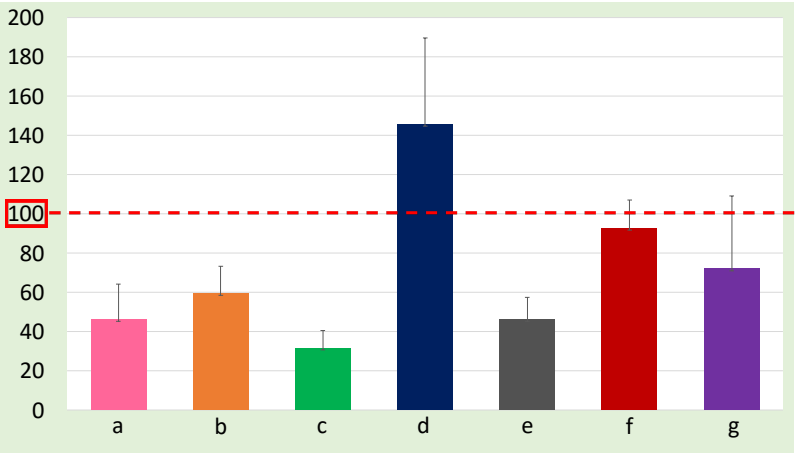

Fig. 6 Average gap volume

Conclusion

This study suggested that the titanium root coping made by the technical scanner alone has a clinically applicable conformance accuracy.

In the future, we will verify the conformance accuracy with a post length of 5 mm or more. We will also consider whether it is possible to set the rotation prevention groove and the keeper housing part and compare their compatibility with the zirconia root coping.

References

1. N. Suto, S. Miura, R. Inagaki, Y. Kaneta, M. Yoda and K. Kimura: A Basic Study on Fitness of All-ceramic Crown Fabricated by CAD/CAM System, Ann Jpn Prosthodont Soc, 1, 21–28, 2009.