A pilot study on the fitness of a zirconia keeper 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 of zirconia root plates fabricated using a high-precision laboratory scanner.

The abutment tooth was a preformed root plate–type epoxy artificial tooth (A50-359, NISSIN). The manufacturing procedure involves scanning the work model using a laboratory scanner (E3, 3Shape), modeling it using design software (Dental System, 3Shape), and then cutting it with a milling machine (CORiTEC 350i, Imes-Icore). Five specimens were tested, and the fitting accuracy of the zirconia root plates 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 set as point g. The average gaps were 61.5±32.2 μm at point a, 73.5±32.4 μm at point b, 41.5±11.6 μm at point c, 148.5±19.1 μm at point d, 45.0±11.6 μm at point e, 81.5±27.8 μm at point f, and 46.0±13.3 μm at point g.

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

Introduction

The progress of dental CAD/CAM systems in recent years has been remarkable, and the further simplification of workflow and improvement in the compatibility of prosthetic devices are expected. At the 26th Annual Scientific Meeting, we examined the suitability of a zirconia root plate manufactured by supplementing the deep part of the model that was difficult to scan using a supplementary scanning post, and we reported that it was acceptable for clinical application. This time, we attempted to fabricate a zirconia root plate with a single system using a dental scanner for laboratory use, which has become more sophisticated and precise in recent years.

Materials and Methods

The abutment was an epoxy artificial tooth (A50-359, NISSIN) with a post part five mm

deep, as recommended by this society. 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 it out using a milling machine (Figs. 1 and 2). The cement space was the specified value of the software, and the number of test samples was five.

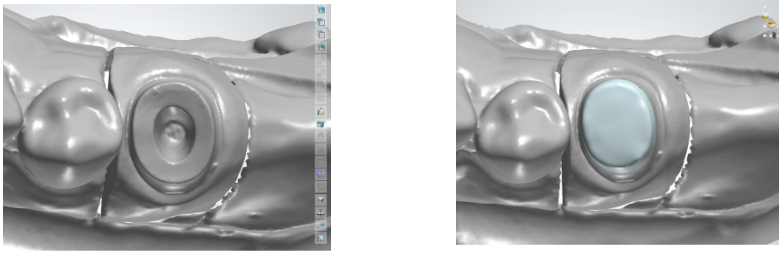

Fig. 1 Scanned model and designed keeper coping

Fig. 2 Fabricated zirconia keeper coping

The fitting accuracy was evaluated using the cement replica method, which quantifies the gap between the model and the root plate based on the thickness of the silicone rubber coating (Fig. 3). 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. 4.

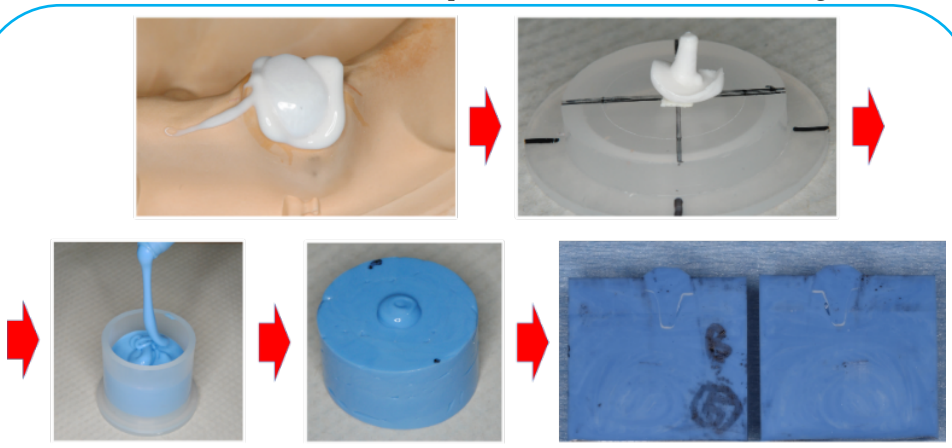

Fig. 3 Fabrication procedure of specimens (Cement-replica technique)

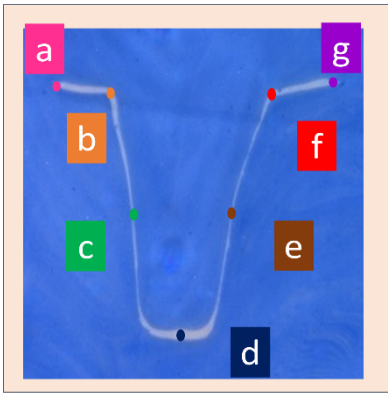

Fig. 4 Measuring points
(a:labial margin b:labial cervical c:labial center of post d: tip of the post e: lingual center of post f: lingual cervical g: lingual margin)

Results

The average gaps are 61.5±32.2 μm at point a, 73.5±32.4 μm at point b, 41.5±11.6 μm at point c, 148.5±19.1 μm at point d, 45.0±11.6 μm at point e, 81.5±27.8 μm at point f, and 46.0±13.3 μm at the g point (Fig. 5). 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.

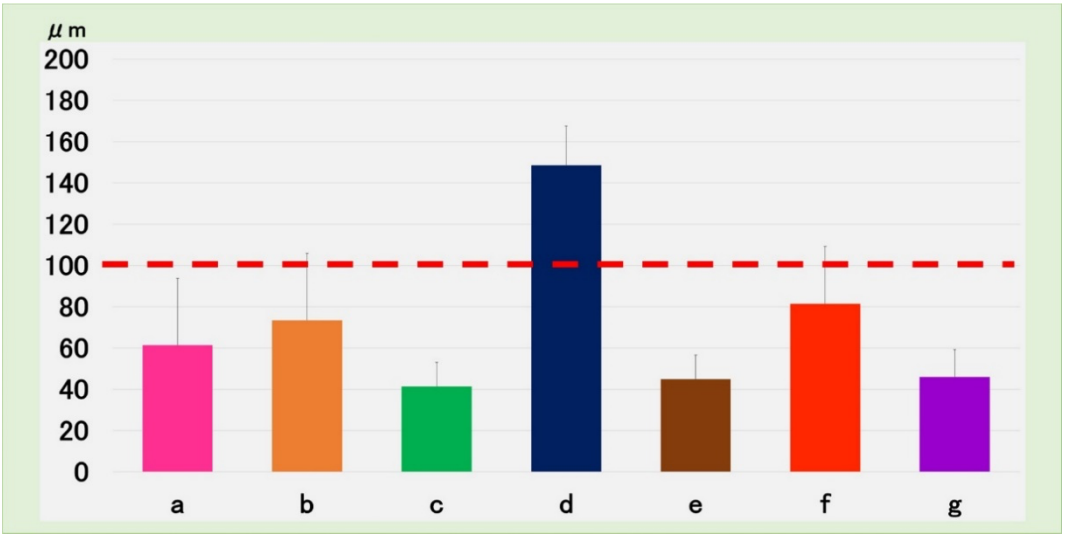

Fig. 5 Average gap volume

Conclusion

The reason compatibility was generally good was thought to be the influence of smooth and highly accurate modeling of the model due to the improved measurement accuracy of the camera and the corresponding software. In addition, the reason the value of point d did not

meet the standard was considered to be that the setting value of the cement space was high as compared to those of other points, and that scanning and milling were somewhat difficult due to the morphology.

In the future, we plan to verify the fitting accuracy with a post length of 5 mm or more and also to investigate whether it is possible to set the anti-rotation groove and the keeper housing.

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.