A basic study on accuracy of a hybrid-resin coping fabricated by CAD/CAM system -Using scanning post and evaluation by μCT-

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Abstract

The purpose of this study was to evaluate the fitting accuracy of hybrid resin copings fabricated by the dental CAD/CAM system and manufacturing using a scanning post.

The desktop scanner (Aadva Scan D850,GC) was used in this study, and images were acquired with a scanning post (Scan Posts™,3shape). Designing software (Dental Designer, GC) was employed for creating a hybrid resin coping design, and a milling machine (Aadva Mill LW-1, GC) was used to fabricate the coping from hybrid resin blocks (CERASMART 270,GC) as specimens(n=5). Desktop μCT (SkyScan 1172,SkyScan) was used to measure the marginal and internal fitting accuracy of a hybrid resin coping and 14 measuring points were evolution in this study.

Within limitations, this study suggested that the fitting accuracy of hybrid resin copings fabricated with this CAD/CAM system using a scanning post was within the clinically acceptable range of 100 ㎛, with the exception of two points (buccal and lingual margins).

Introduction

The progress of dental CAD/CAM systems has made it possible to fabricate various clinical applications including inlays, onlays, crowns, bridges, all-ceramic frameworks, and more dentures in clinical dentistry and has made possible the creation of highly accurate products. Several reports introduced the fabrication of root canal copings or posts and cores using CAD/CAM[1–3]; however, they had scanned the acrylic resin pattern and milled and sintered it onto another material for a root canal coping or post and core instead of investing and casting the pattern into the metal. The technique used the same initial procedures for creating a metal cast coping or post and core.

Our present study[4] introduced a method of fabricating CAD/CAM keeper copings using a scanning post Scan Posts™,3shape) and revealed no significant difference in the cement space for internal fitting; however, the marginal fitting accuracies were not clear.

The purpose of this study was to evaluate the fitting accuracy of hybrid resin copings fabricated by the CAD/CAM system with a scanning post.

Materials and Methods

Prepared epoxy resin mandibular canine teeth (338, Nissin) were selected as the abutment teeth for the copings, and the root canal was recontoured with a drill (ParaPost X Drill, Coltene-Whaledent) to fit the same form of scan posts and pressed to a depth of 5.0 mm, creating a rotational resistance groove and additional reduction to gain more clearance (Fig.1).

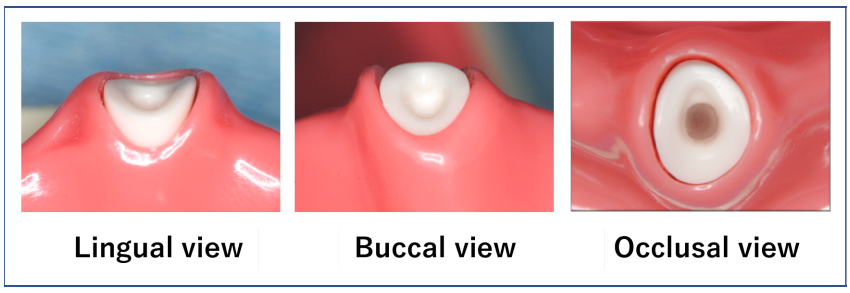

Fig.1 Abutment tooth form for coping

The copings were made from a hybrid resin block (CERASMART 270, GC). They were designed using CAD software (Dental Designer, 3Shape) after digitalization of the die was performed using a desktop scanner (Aadva Scan D850, GC), and they were fabricated by a milling unit (Aadva MILL LW-1, GC) in

this study (Fig.2). The cement space was set based on our study (Fig.3).

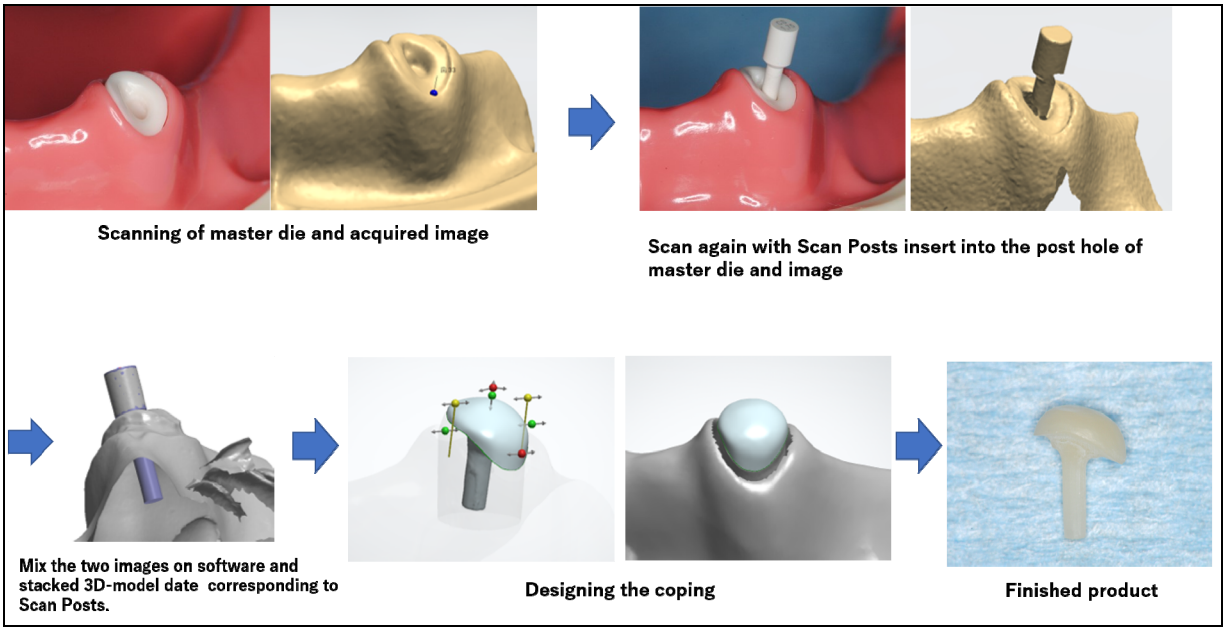

Fig.2 Work flow of scanning and designing coping

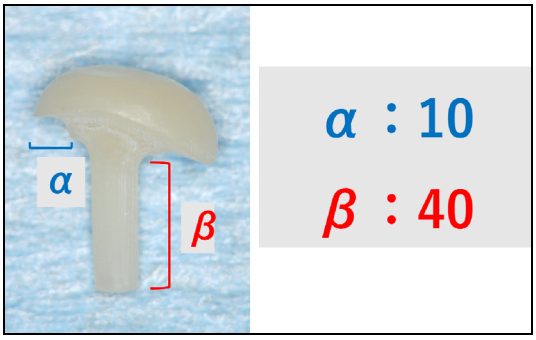

Fig.3 Cement space (㎛)

The hardware device used in this study was a desktop μCT scanner (SkyScan 1172, SkyScan) for the evolution of the fitting accuracy of hybrid resin copings. Images were acquired using 104 kV voltage, 100 μA current, and a 0.5 mm thick aluminum filter. After being scanned, the images were reconstructed in the software (NRecon, SkyScan), and the space between the hybrid resin coping and the abutment was measured using the instrument (CTAn, SkyScan). Measurement points are shown in Fig.4.

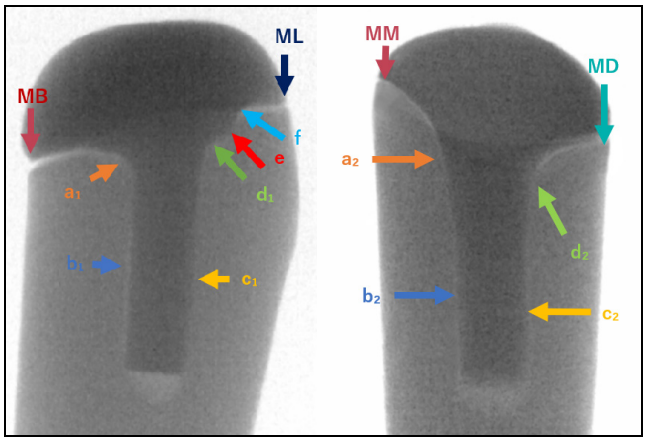

Fig.4 Measurement points in this study. MB: margin of buccal; ML: margin of lingual; MM: margin of mesial; MD: margin of distal

Results

The mean space between the hybrid resin coping and the abutment of each point is shown in Figs.5 and 6.

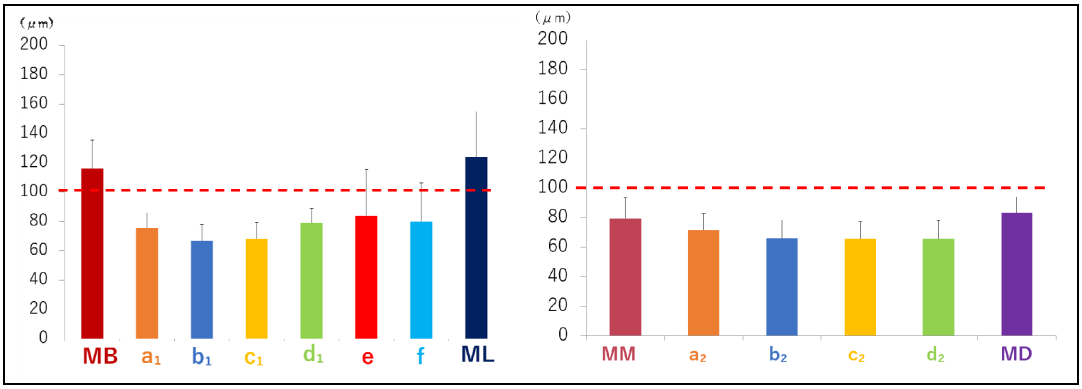

Fig.5,6 The mean space between hybrid resin coping and abutment

All points except MB and ML had spaces of less than 100 μm between the hybrid resin coping and the abutment.

Discussion

The fitting accuracy of Point MB and Point ML were inferior to the clinically acceptable range of 100 μm.[5] This fact could be attributed to the setting of the sprue position in the software. Point MB was located on the sprue side (Fig.7). This region may be unfavorable for cutting the details of the margin due to the fact that the milling pathway was inhibited by the sprue. Point ML was located on the opposite side of the sprue because Point ML was located at the opposite end of a hybrid resin block, and this area was susceptible to damage during the milling process. The hybrid resin block would be bent in the opposite direction of the milling load side and would be increased. This fact seems to depend on the characteristics of the CAD/CAM milling blocks.

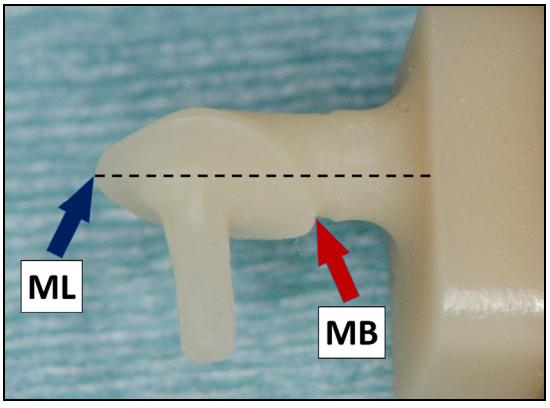

Fig.7 Location of point MB and ML after milling

Conclusion

Within the limitations of this study, it was suggested that the fitting accuracy of hybrid resin copings fabricated with this CAD/CAM system using scan posts was within the clinically acceptable range, excluding MB and ML.

References

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