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CLINICAL REPORT

Providing a monolithic zirconia fixed partial denture with rigid and nonrigid connectors to overcome nonparallel abutment teeth

Yu Takaesu, DDS, PhD,[a] Kota Isshi, DT,[b] Taisei Toguchi, DDS,[c] and Takashi Matsuura, DDS, PhD[d]

ABSTRACT

This clinical report describes the fabrication of a monolithic zirconia fixed partial denture using rigid and nonrigid connectors to overcome nonparallel abutment teeth. A precise key and keyway in the ceramic material was designed with digital technology, reducing material costs, improving biocompatibility, and using esthetically superior nonmetallic materials. (J Prosthet Dent 2025;133:335-339)

Monolithic zirconia (MZ) fixed partial dentures (FPDs) have become a popular option for posterior prostheses because of rapid production, low cost, excellent biocompatibility, high mechanical strength, and excellent short-term survival rates.[1–3] In patients with 1 or 2 missing teeth between nonparallel abutment teeth, prosthodontic treatment options may include implant-supported crowns or FPDs with a nonrigid connector, typically fabricated from metal by the lost-wax technique. However, ceramic crowns have been preferred to metal-ceramic crowns,[4,5] and the development of computer-aided design and computer-aided manufacturing (CAD-CAM) technology has led to prostheses within the clinically acceptable marginal discrepancy range comparable with those fabricated by the traditional lost-wax technique.[6] This clinical report describes the fabrication of a monolithic zirconia FPD with rigid and nonrigid connectors to overcome nonparallel abutment teeth. This report was approved by the Research Ethics Committee of Fukuoka Dental College (#624).

CLINICAL REPORT

A 64-year-old woman was referred to the Prosthodontic Clinic in Fukuoka Dental College Hospital in December 2018. She had an interim 5-unit FPD replacing the maxillary right first and second premolars and ill-fitting metal-ceramic FPDs in the remaining posterior regions (Fig. 1). Her chief complaint was poor esthetics because of metal display with chipped porcelain and metal posterior crowns. The preliminary treatment plan included removal of the ill-fitting posterior prostheses and the provision of interim restorations maintaining canine guidance, followed by the replacement of monolithic zirconia fixed partial dentures (MZFPDs). However, in the mandibular right posterior region, the tilted FPD abutments could not be prepared with a common path of placement (Fig. 2). Although the inclusion of 2 implant crowns to replace the mandibular first premolar and first molar was recommended, this option was declined because of fear of surgery. As canine guidance was maintained with the intact canine, a cantilever FPD excluding the intact canine was considered a better prosthetic design, and the patient selected a cantilever MZFPD with rigid and nonrigid connectors to be placed in the mandibular right posterior region.

The abutment teeth were prepared with chamfer margins and axial and occlusal reductions of 2.0 mm or more (Fig. 2). An impression was made with polyvinyl

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[a]Assistant Professor, Department of Oral Rehabilitation, Section of Fixed Prosthodontics, Fukuoka Dental College, Fukuoka, Japan.
[b]Dental Technician,Fukuoka Dental College Medical Dental General Hospital Central Dental Laboratory, Fukuoka, Japan.
[c]Graduate student, Department of Oral Rehabilitation, Section of Fixed Prosthodontics, Fukuoka Dental College, Fukuoka, Japan.
[d]Professor, Department of Oral Rehabilitation, Section of Fixed Prosthodontics, Fukuoka Dental College, Fukuoka, Japan.

Figure 1. Intraoral views before treatment.

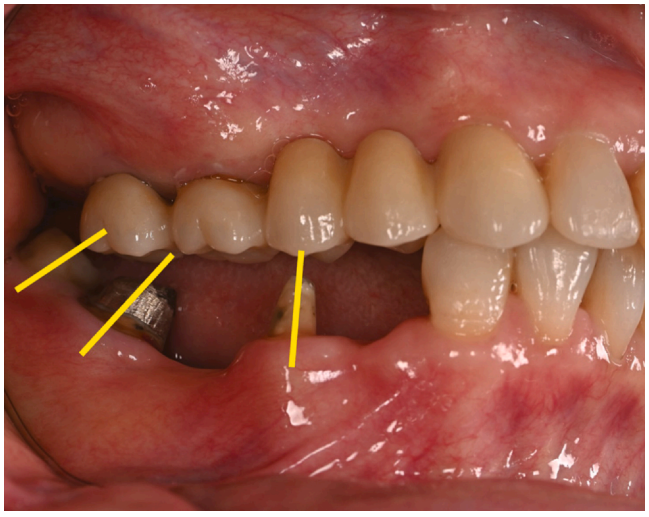

Figure 2. Abutment teeth and tooth axes.

siloxane material (Imprint II Garant Light Body + Imprint II Penta Heavy Body; 3M ESPE) and poured with Type IV gypsum (Fuji Rock EP; GC). The casts were scanned (KaVo LS 3; KaVo Planmeca), and the cantilever FPD with rigid and nonrigid connectors was designed by using a software program (exocad DentalCAD; exocad GmbH). The nonrigid connection was positioned on the distal portion of the mandibular right second premolar (Fig. 3A, B). The FPD was milled (Aadva Mill LD-1; GC) from a semisintered zirconia block (KATANA STML; Kuraray Noritake Inc) and completely sintered in an oven (S6 MS-3316; Motoyama Inc), followed by fine adjustments, polishing, staining, and glazing (CERABIEN ZR External Stain; Kuraray Noritake Inc) (Fig. 3C, D). The intaglio surface was airborne-particle abraded with 50 to 70 μm Al_2O_3, followed by the application of 10-methacryloyloxydecyl dihydrogen phosphate primer (Clearfil ceramic primer plus; Kuraray Noritake Inc). The abutment tooth was etched with 37% phosphoric acid (K-etchant gel; Kuraray Noritake Inc), a primer (ED Primer; Kuraray Noritake Inc) was applied, and the definitive prosthesis was cemented with resin cement (PANAVIA V5; Kuraray Noritake Inc). The marginal fit, morphology, color tone,

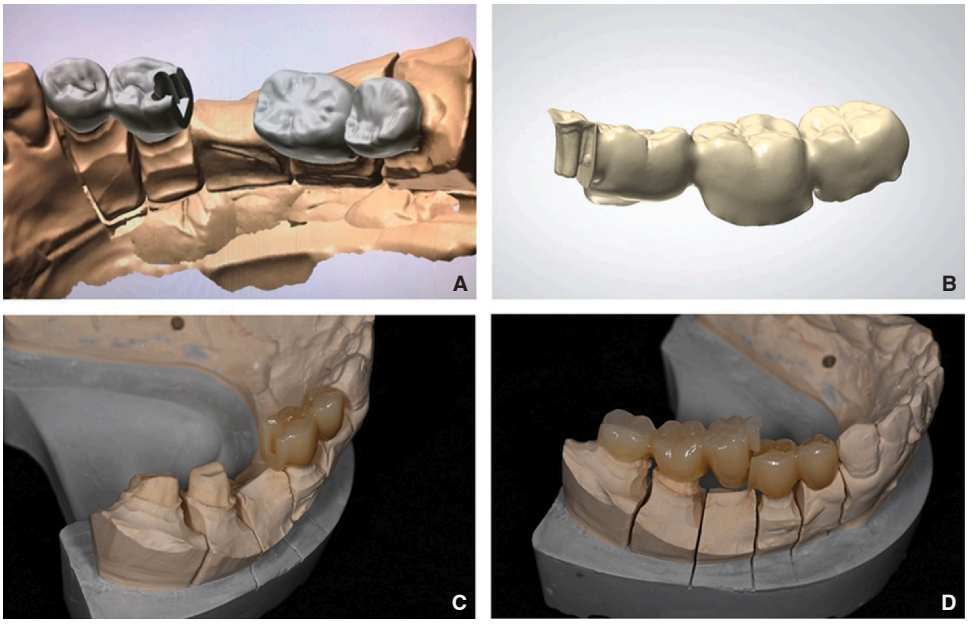

Figure 3. Fabrication of cantilever monolithic zirconia fixed partial denture with rigid and nonrigid connectors. A, Design of keyway. B, Design of key. C, Key of definitive prosthesis. D, Key and keyway of definitive prosthesis.

and surface of the prosthesis were evaluated with the California Dental Association (CDA) quality system,[7] and all measures were assessed as excellent by 3 raters.

At the 6-month follow-up, the patient was satisfied in terms of esthetics, mastication, speech, and comfort. Follow-up of the prostheses and surrounding tissues continued every 6 months, and the occlusal morphology was checked every year by making impressions and scanning the casts and converting them into 3-dimensional data as described previously, followed by 3-year data collection. The occlusal morphology and contact with the opposing teeth were analyzed at each annual follow-up with those values at the time of delivery. The occlusal morphology did not alter throughout the 3-year follow-up (Fig. 4), and the occlusal contact to the opposing teeth did not change (Fig. 5). Biological and technical complications such as debonding were absent for 3.5 years after treatment (Fig. 6).

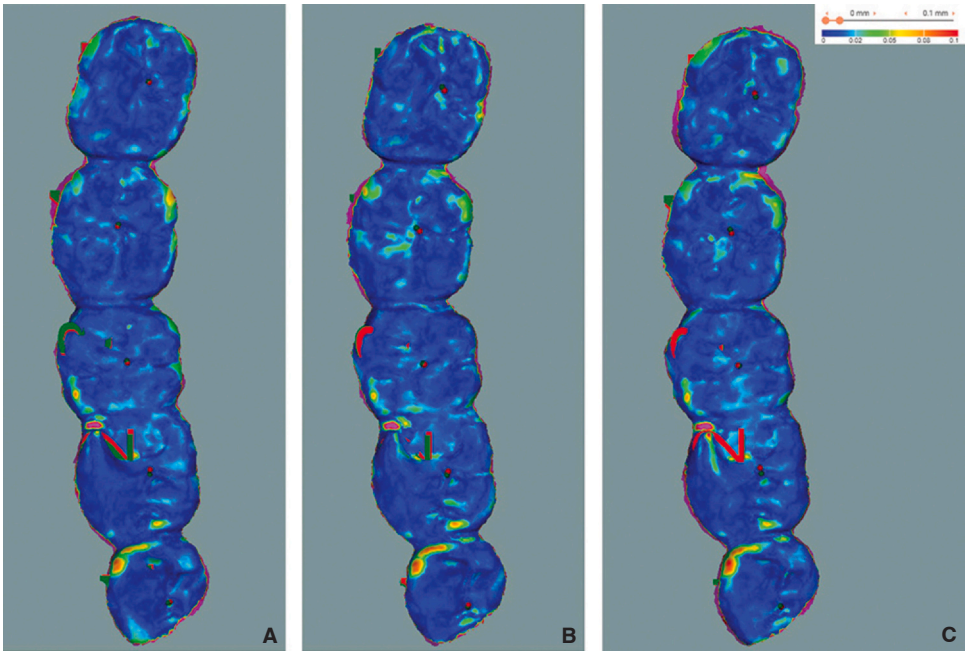

Figure 4. Occlusal morphology at each follow-up time in comparison with original one. A, At 1-year follow-up. B, At 2-year follow-up. C, At 3-year follow up. *Blue*: same as original. *Red* or *green* color, deviation from original.

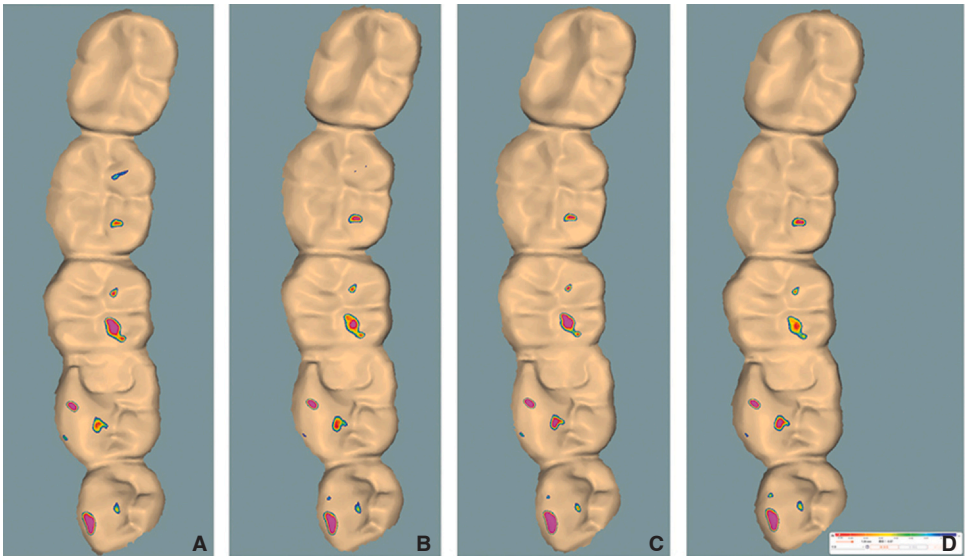

Figure 5. Occlusal contact (*red*) at each follow-up time. A, At delivery. B, At 1-year follow up. C, At 2-year follow up. D, At 3-year follow up.

Figure 6. Intraoral views at 3.5 years after treatment.

DISCUSSION

Impression accuracy directly affects fit accuracy. As the accuracy of digital scans suggests that they should only be used for the fabrication of crowns and short-span FPDs,[8,9] a conventional impression was made for fabricating the 5-unit FPD for this patient. She had no clinical signs of bruxism beneficial because bruxism has been associated with complications of MZFPDs.[10] Canine guidance was used, as it has been considered to protect the posterior prostheses against occlusal wear,[11] although a systematic review has reported that canine guidance and group function do not differ in prosthesis longevity.[12] She has MZ prostheses occluding with each other (Fig. 6), but whether this arrangement might have different longevity from those occluding with prostheses fabricated from different materials or with natural teeth is unclear.[13] The present report demonstrated that current digital technology can provide a prosthesis with rigid and nonrigid connectors with clinically acceptable marginal fit if an accurate conventional impression and definitive cast are used.

SUMMARY

This clinical report presents treatment using a cantilever MZFPD with rigid and nonrigid connectors to overcome nonparallel abutment teeth. This MZFPD was adapted to the abutment teeth at a clinically acceptable level and has shown been successful for 3.5 years.

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Corresponding author:
Dr Yu Takaesu
Section of Fixed Prosthodontics
Department of Oral Rehabilitation
Fukuoka Dental College
15–1 Tamura 2-chome
Sawara-ku, Fukuoka 814–0193
JAPAN
Email: takaesu@fdcnet.ac.jp

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