Rotational Path of Insertion in Fixed Prosthodontics when Abutment Axes Do Not Match: A Case History Report

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Fixed dental prostheses (FDPs) are the standard treatment option for replacing missing teeth when adjacent teeth require crowns or already have crowns. Divergent abutment teeth axes may require invasive teeth preparation to achieve a common path of insertion, which substantially weakens residual tooth structure and increases the risk of pulpal problems. In selected cases with divergent abutment teeth in the buccal-lingual direction, the use of a rotational path of insertion might overcome these problems. This concept is presented via a clinical case history report. Int J Prosthodont 2019;32:444–447. doi: 10.11607/ijp.6139

FDP WITH A ROTATIONAL PATH OF INSERTION

A healthy 66-year-old female patient sought routine dental treatment in the undergraduate student clinic in the Department of Prosthodontics, Propaedeutics and Dental Materials, Christian-Albrechts University, Kiel, Germany.
The right mandibular first molar was nonrestorable due to a radio translucency in the apical region following root canal treatment and apicoectomy. The patient was informed of the different treatment options for a single missing tooth, including dental implants and removable partial dentures. She asked for a fixed restoration and selected a monolithic zirconia FDP. During intraoral inspection, the divergent teeth axes of the right mandibular second premolar and the right mandibular second molar, both restored with partial crowns, were obvious. A study cast analysis (Fig 1) revealed the risk of a pulpal involvement with a necessary root canal treatment on at least one of the teeth when trying to find a linear path of insertion for both abutment teeth. In order to avoid this, an FDP with a rotational path of insertion was planned for replacement of the mandibular right first molar.

The site was treated according to the immediate pontic technique. After local anesthesia, the two adjacent teeth were prepared for an FDP following the individual tooth axes in the buccal-lingual direction, resulting in divergent tooth axes of the abutment teeth in the buccal-lingual direction. No undercuts were allowed in the mesial-distal direction. After abutment tooth preparation, the mandibular right first molar was extracted. A provisional FDP was fabricated and inserted immediately after tooth extraction to stabilize the soft tissue in the pontic rest area. The provisional could not be inserted in a linear direction, but had to be rotated into its final position. The provisional also served as a control to verify the correct rotational insertion of the planned final FDP despite the divergent tooth preparation of the abutment teeth. After complete wound healing and abutment tooth preparation finalization (Fig 2), an impression was taken and poured with type IV plaster. The master model, as well as the maxillary cast, were scanned with a laboratory scanner (D-900, 3shape) (Fig 3). The FDP was designed digitally (Dental Designer, 3shape). The software revealed problems with the undercuts of the abutment teeth in the buccal-lingual direction when trying to find an ideal path of insertion. The drilling compensation offset had to be turned off (Fig 4) in order to design a functional FDP (Fig 5a). After milling the FDP from a high-strength multilayer monolithic zirconia block (Katana Zirconia ML, Kuraray Noritake) in a milling unit (Zenotec select hybrid, Ivoclar Vivadent), the drilling compensation offset had to be done manually to achieve an optimal fit of the FDP. The finalized FDP was stained and glazed (Fig 5b).

A recall examination was performed 2 weeks after insertion (Fig 6). The FDP was functioning well, and the patient did not report any problems regarding the new restoration.
DISCUSSION

It has been a commonly accepted and virtual dogma that FDPs should be designed to fit over parallel abutments. Boer and Boer introduced the concept of an FDP with a rotational path of insertion for abutments with undercuts in the buccal-lingual direction, a protocol in which the FDP is inserted using a combination of translation and rotation. In the present case, this approach permitted preparation of the two abutment teeth in their individual tooth axes in the buccal-lingual direction.

The selected patient’s two abutment teeth revealed opposing tooth axes in the buccal-lingual direction, and parallelization of the abutments for a linear path of insertion would have presented severe risks for the pulp. A systematic literature review reports that the 5-year cumulative loss rate of abutment tooth vitality for densely sintered zirconia FDPs is 2.2% (95% confidence interval 0.5% to 8.6%). In a clinical study, outcomes of vital pulps beneath metal-ceramic crowns or FDPs were analyzed. The authors concluded that the survival rate of the vital pulp in teeth restored with single crowns...
was significantly higher than that when serving as abutments for FDPs. The authors saw the main reason in the need for additional tooth reduction to align the preparations for a linear path of insertion.

The FDP with a rotational path of insertion protocol enables an abutment tooth preparation following the individual tooth axes of the abutment teeth with no need for parallelism in the buccal-lingual direction. That way, a considerable amount of sound tooth structure can be preserved and the risk of an irreversible pulp trauma can be reduced. However, an FDP with a helical path of insertion is not possible on abutment teeth with undercuts in the mesial-distal direction, as adjacent teeth do not allow a rotation of the FDP in the mesial-distal direction.

The technical completion of the FDP needed some additional efforts due to the fact that the drilling compensation offset had to be done manually after milling of the restoration, as the current computer-aided design/computer-assisted manufacturing software is not programmed to allow a rotational path of insertion for FDPs.

CONCLUSIONS

Treatment options for single-tooth replacement with an FDP, when confronted with the selection of abutment teeth with divergent axes in the buccal-lingual direction, should include consideration of a rotational path of insertion for the planned prosthesis. The described protocol avoids the risk of more invasive tooth preparation and associated problems.

ACKNOWLEDGMENTS

The authors thank Reinhard Busch, dental technician, for his enthusiasm when designing and fabricating the FDP with a rotational path of insertion. The authors declare that they have no conflicts of interest.

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Literature Abstract

Exploring the Association Between Alzheimer’s Disease, Oral Health, Microbial Endocrinology and Nutrition

Longitudinal monitoring of patients suggests a causal link between chronic periodontitis and the development of Alzheimer’s disease (AD). However, the explanation of how periodontitis can lead to dementia remains unclear. A working hypothesis poses extrinsic inflammation as a secondary cause of AD and suggests that compromised oral hygiene leads to a dysbiotic oral microbiome whereby a keystone periodontal pathogen, Porphyromonas gingivalis, along with its companion species, orchestrates immune subversion in the host. Brushing and chewing on teeth supported by already injured soft tissues leads to bacteremia. As a result, a persistent systemic inflammatory response to periodontal pathogens is developed. The pathogens and the host’s inflammatory response subsequently lead to the initiation and progression of multiple metabolic and inflammatory comorbidities, including AD. Insufficient levels of essential micronutrients can lead to microbial dysbiosis through the growth of periodontal pathogens, such as demonstrated for P gingivalis under low hemin bioavailability. An individual’s diet also defines the consortium of microbial communities that take up residency in the oral and gastrointestinal (GI) tract microorganisms. Their imbalance can lead to behavioral changes. For example, probiotics enriched in the Lactobacillus genus of bacteria, when ingested, exert some anti-inflammatory influence through common host/bacterial neurochemicals, both locally and through sensory signaling back to the brain. Early-life dietary behaviors may cause an imbalance in the host/microbial endocrinology through a dietary intake incompatible with a healthy GI tract microbiome later in life. This imbalance in host/microbial endocrinology may have a lasting impact on mental health. This observation opens up an opportunity to explore the mechanisms that may underlie the previously detected relationships of diet and oral/GI microbial communities with anxiety, cognition, and sleep patterns. This review suggests that healthy diet-based interventions, together with improved lifestyle/behavioral changes, may reduce and/or delay the incidence of AD.

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