







Communication

# Two-Year Longevity of Posterior Zirconia Multi-Unit Fixed Dental Prostheses with Monolithic Occlusal Surface

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**Abstract:** In this prospective clinical trial we observed the 2-year clinical performance of posterior tooth-supported multi-unit fixed dental prostheses (FDP) fabricated from zirconia with monolithic occlusal surfaces. Fifty multi-unit FDPs were inserted in 50 patients. After two years of clinical service, 43 restorations were reexamined as one patient had died and six patients were not available for recall. Two biological (root canal treatment: 12 and 14 months) and one technical (debonding: 12 months) complications occurred. According to the Kaplan–Meier analysis, the success rate was 93.7%, and the survival rate was 100%. The six patients who were not available for regular 2-year follow-up were examined after the official 2-year recall interval, and none of the FDPs presented complications or failures. Within the limitations of the current study, the use of multi-unit FDPs with monolithic occlusal surfaces fabricated from zirconia can be recommended for short-term use in the posterior area.

**Keywords:** ceramics; dental prosthesis; dental restoration; permanent; Y-TZP ceramic; zirconium



**Citation:** Pahncke, E.; Hahnel, S.; Schierz, O.; Schmidt, M.B.; Schmutzler, A.; Rauch, A. Two-Year Longevity of Posterior Zirconia Multi-Unit Fixed Dental Prostheses with Monolithic Occlusal Surface. *Appl. Sci.* **2021**, *11*, 4449. <https://doi.org/10.3390/app11104449>

Academic Editor: Amr S Fawzy

Received: 26 March 2021

Accepted: 11 May 2021

Published: 13 May 2021

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## 1. Introduction

In comparison to silica-based ceramics, zirconia features the clinical benefits of higher flexural strength and less invasive preparation design. However, clinical complications are frequently reported, especially for chipping of the veneering ceramic [1]. Structural improvements of zirconia enhanced the translucency of the opaque material and enabled its use in a monolithic approach [2]. A few clinical studies observed the short-term longevity (up to three years) of tooth-supported multi-unit FDPs fabricated from 3 mol% yttria-stabilized zirconia, reporting survival rates from 93.8% to 100% [3,4]. For tooth- and implant-supported restorations, rates of 93.3% for survival and 81.8% for success were determined after the 2-year follow-up [5].

The aim of the present prospective study was to add data on the short-term performance of tooth-supported 3 mol% yttria-stabilized zirconia multiple-unit FDPs in the posterior area that are featured by monolithic occlusal surfaces.

## 2. Materials and Methods

Fifty patients were consecutively recruited at the Department of Prosthodontics and Materials Science, University of Leipzig, Germany who required treatment with a multi-unit FDP fabricated from zirconia in the posterior area (Table 1). Only FDPs with a terminal abutment design were included. Other inclusion criteria were vital or successfully endodontically treated abutment teeth with a biological width of at least 2 mm, healthy periodontal conditions, and sufficient oral hygiene. Exclusion criteria were patients aged 17 or younger, pregnancy, patients with multiple general diseases, and patients with xerostomia.

**Table 1.** Characteristics of the patient population and restorations.

Parameter	Outcome			
Age (years)	mean 56.9 ± 13.1; min. 29; max. 80			
Gender	52.0% female	48.0% male		
Units	74.0% (3 units)	16.0% (4 units)	8.0% (5 units)	2.0% (6 units)
Veneering	28.0% facial	72.0% no veneering		
Material (manufacturer)	62.0% Zenostar ZR translucent (Wieland, Pforzheim, Germany)	20.0% Lava Plus (3M, Saint Paul, MN, USA)	10.0% DD Bio ZX <sup>2</sup> (Dental Direkt, Spenge, Germany)	8.0% NexxZr T (Sagemax, Lindau, Germany)
Cementation	14.0% zinc oxide phosphate	52.0% glass ionomer cement	34.0% RelyX Unicem (3M, Saint Paul, MN, USA)	

Further information is available in a previous publication [6]. The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethical Committee of the University of Leipzig (#298-14-25082018). All patients gave their written consent to take part in this investigation. The study was registered at the German Register of Clinical Studies (DRKS00019935). The preparation of abutment teeth was performed by either undergraduate students who were shadowed by an experienced dentist during the clinical courses in prosthodontics or by dentists of the department.

The preparation design was chosen according to guidelines for zirconia restorations [7] and dual-phase silicone impressions (Aquasil Ultra, Dentsply Sirona, Bensheim, Germany) were taken. All FDPs were fabricated in two dental laboratories and milled from 3 mol% yttria-stabilized zirconia. For some clinical scenarios, silica-based ceramics were used for facial veneering. After try-in procedures, the adjusted FDPs were properly polished and either conventionally or self-adhesively cemented (Table 1). The follow-up appointments comprised a baseline examination and reevaluations after 12 and 24 months.

The observed events were categorized as events with technical or biological origin. Moreover, failures were categorized as either the replacement of a restoration or extraction of an abutment tooth. Complications comprised restorations that required intervention but were still acceptable for intraoral service. Statistics were performed (SPSS 27, IBM, Armonk, NY, USA) by using Kaplan–Meier analysis to determine the survival (failure) and success (failure and complications) rates and 95% confidence intervals (CI).

### 3. Results

Between June 2014 and July 2018, a total of 50 patients were supplied with 50 zirconia multi-unit FDPs (28.0% facially veneered). Detailed information is presented in Table 1 and in a previous publication (6). At two-year follow-up ( $24.2 \pm 2.2$  months), 43 patients were examined; one patient had died, and six patients could not be recruited for recall.

Three complications occurred: two restorations required root canal treatment and one FDP debonded (Table 2, Figure 1). Regarding the restoration that debonded, chipping of the facial veneering occurred after 24 months, which was compensated by grinding and polishing. The success rate was 93.7% [95% CI 86.8; 100] and the survival rate was 100%. The six patients who were not available for the regular 2-year follow-up could be examined after the official 2-year recall interval, and none of the FDPs presented a complication or failure.

Table 2. Overview of the events.

Event	Units/Facial Veneering	Material	Cementation	Type of Event	Time of Event (Months)
I complication	3/yes	Zenostar ZR translucent (Wieland, Pforzheim, Germany)	glass ionomer cement	technical, debonding	12
II complication	4/no	Zenostar ZR translucent (Wieland, Pforzheim, Germany)	glass ionomer cement	biological, symptomatic irreversible pulpitis	12
III complication	4/yes	Lava Plus (3M, Saint Paul, MN, USA)	glass ionomer cement	biological, asymptomatic apical periodontitis	14

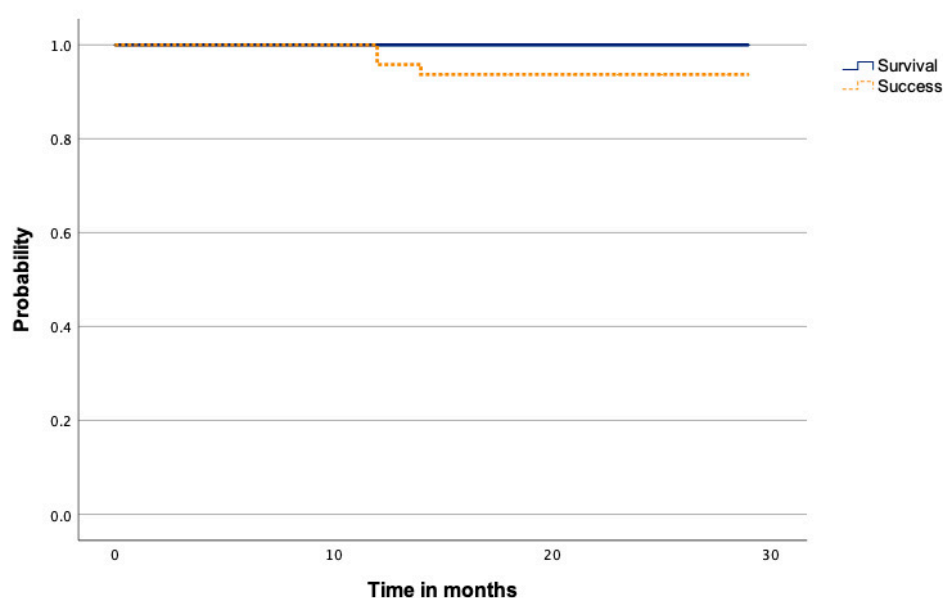


Figure 1. Kaplan–Meier curves for the survival and success of multi-unit fixed partial dentures with monolithic occlusal surfaces fabricated from zirconia (insertion  $n = 50$ ; 2-year follow-up  $n = 43$ ).

#### 4. Discussion

The survival (100%) and success (93.7%) rates determined in the present study were similar to previous investigations examining multi-unit FDPs [3,4]. For single crowns, slightly lower survival rates (92.8–98.5%) were reported after three years of intraoral use [8,9]. In general, differences of survival rates for monolithic zirconia restorations might be explained by variations in the manufacturing process—particularly during occlusal adjustments [9]. Regarding complications, the extensive wear of zirconia or antagonists against zirconia has been described and discussed but might be neglectable when premising a properly polished zirconia surface [10,11].

Therefore, these considerations emphasize that monolithic occlusal surfaces fabricated from zirconia could be an interesting option for patients with bruxism. In these clinical scenarios, short-term clinical use was positively evaluated in several clinical trials [5,12,13]. In the present study, bruxism was not assessed according to the current international guidelines but was not explicitly excluded [14]. Another shortcoming of this study is the limited sample size, which was due to the long-lasting recruiting process of patients. Nevertheless, the results of this study suggest that the short-term clinical use of multi-unit FDPs fabricated from monolithic zirconia in the posterior region can be recommended.

**Author Contributions:** E.P. data curation, investigation, formal analysis, software, visualization, and writing original draft; S.H. project administration, resources, supervision, validation, and writing review & editing; O.S. conceptualization, methodology, supervision, and writing review & editing; M.B.S. investigation, validation, and writing review & editing; A.S. investigation, validation, and writing review & editing; A.R. conceptualization, formal analysis, methodology, software, visualization, and writing review & editing. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of University of Leipzig (#298-14-25082018).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Data can be requested from the authors upon reasonable request.

**Acknowledgments:** The authors acknowledge support from Leipzig University for Open Access Publishing.

**Conflicts of Interest:** The authors declare no conflict of interest.

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