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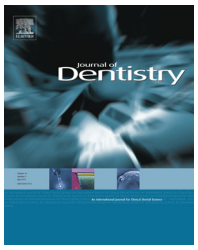

Clinical survival of indirect, anterior 3-unit surface-retained fibre-reinforced composite fixed dental prosthesis: Up to 7.5-years follow-up☆

Ovul Kumbuloglu [a], Mutlu Özcan [b,*]

[a] Ege University, School of Dentistry, Department of Prosthodontics, Izmir, Turkey
[b] University of Zurich, Dental Materials Unit, Center for Dental and Oral Medicine, Clinic for Fixed and Removable Prosthodontics and Dental Materials Science, Zurich, Switzerland

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ABSTRACT

Objectives: This prospective clinical study evaluated the performance of indirect, anterior, surface-retained, fibre-reinforced-composite restorations (ISFRCR).
Methods: Between June-2003 and January-2011, a total of 134 patients (83 females, 51 males, 16–68 years old) received 175 ISFRCRs (local ethical registration number: 14/9/4). All restorations were made indirectly on a plaster model using unidirectional E-glass fibres (everStick C&B, StickTech) in combination with a laboratory resin composite (Dialogue, Schütz Dental) and cemented according to the instructions of 4 resin cements [(RelyX ARC, 3M-ESPE, $n = 61$), Bifix DC, VOCO, $n = 45$), Variolink II (Ivoclar Vivadent, $n = 32$) and Multilink (Ivoclar Vivadent, $n = 37$)]. After baseline recordings, patients were followed at 6 months and thereafter annually up to 7.5 years. The evaluation protocol involved technical (chipping, debonding or fracture of tooth/restoration) and biological failures (caries).
Results: Mean observation period was 58 months. Altogether, 13 failures were observed [survival rate: 97.7%] (Kaplan–Meier). One catastrophic fracture [(cement: RelyX ARC), eight partial debonding (cement: Bifix DC (5), Multilink (1), RelyX ARC (1), Variolink II (1)] and four delaminations of veneering composite [(cement: Bifix DC (2), RelyX ARC (1), Multilink (1)] were observed. Except one replacement, all defective restorations were repaired or recemented. Annual failure rate of ISFRCRs was 1.73%. The survival rates with the four resin cements did not show significant differences (RelyX ARC: 98.3%; Bifix DC: 93.5%; Variolink 2: 100%; Multilink: 100%) ($p = 0.114$). Secondary caries did not occur in any of the teeth.
Conclusion: The 3-unit anterior indirect surface-retained resin-bonded FRC FDPs showed similar clinical survival rate when cemented with the resin cements tested. Experienced failures in general were due to debonding of the restoration or delamination of the veneering composite.

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* *Corresponding author at*: University of Zürich, Dental Materials Unit, Center for Dental and Oral Medicine, Clinic for Fixed and Removable Prosthodontics and Dental Materials Science, Plattenstrasse 11, CH-8032 Zürich, Switzerland. Tel.: +41 44 63 45600; fax: +41 44 63 44305.
E-mail address: mutluozcan@hotmail.com (M. Özcan).

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1. Introduction

Q3 Adhesion of resin-based materials to enamel and dentine, and developments in resin composites transformed the application of invasive therapy options to minimal invasive ones in reconstructive dentistry. Missing anterior teeth can be restored with a wide range of therapy options such as partial removable dentures, resin-bonded fixed dental prosthesis (FDP) made of metal–ceramic, all ceramic, fibre reinforced composite (FRC), conventional full coverage FDPs, or implants. Each of these techniques has both advantages and disadvantages, and some of the latter may include overall complexity, with biological and financial costs, and cause difficulties in maintaining oral hygiene. Full coverage FDPs present the longest track but this indication requires abutment tooth preparation yielding to irreversible biological costs.[1] On the other hand, indication of implant-supported FDPs certainly increased dramatically over the last two decades but the incidence of biological complications such as peri-implantitis and its therapy has not been resolved yet.[2] Among the minimal invasive options, studies on metal–ceramic resin-bonded FDPs reported debonding at the metal–composite cement or enamel–composite cement interface.[3,4] Fractures and debondings were more commonly reported with all ceramic resin-bonded FDPs as the main technical complications.[5] In addition, favourable occlusion accompanied with sufficient space for the metal are required in order to minimize the direct stress on the FDP.[3,4]

Recently, the use of FRC applications has greatly increased in dentistry in the form of root posts,[6] periodontal splints,[7] or bonded FDPs.[8–12] Structurally, an FRC is composed of two components namely, the resin matrix that serves as carrier and protector of the fibres and the specifically oriented fibres with the purpose of improving the mechanical properties of resin composite. Ultrahigh molecular weight polyethylene, E-glass or S-glass, aramid (Kevlar) and carbon fibres are the most frequently used FRC materials for the construction of FDPs.[13] Among different fibre materials, silanized and preimpregnated glass fibres are more commonly used because of their favourable optical properties, possibility to withstand tensile stresses and prevent crack propagation in resin matrix.[14,15] When fabricating FRC FDPs, reinforcement with long unidirectional fibres at the tensile side of the construction is recommended.[14,15] Such FDPs can be fabricated either directly in the mouth or indirectly by a dental technician. When compared with the direct technique, the indirect technique offers ease of working, a higher degree of conversion rate for the veneering composite and a better surface finish.[16] In the case of surface-retained applications, indirect FRC FDPs are then bonded directly onto enamel and in the case of retentive ones, they are bonded to the cavities that have margins in enamel/dentine complex.

Studies on clinical performance of resin-bonded FRC FDPs are limited. Overall survival rate of 75% and functional survival rate of 93% were reported after a follow-up period of 24–63 months.[8–12] One systematic review on clinical survival of commercially available different FRC products without discrimination between type of retainers, fabrication technique, type of fibres, cements, preparation designs, have been published.[17] This systematic review summarized the survival rate of FRC FDPs based on a limited number of clinical studies, all of which reported relatively short follow-up results. Problems associated with commonly used FRC systems included fractures, wear and discoloration of the veneering resin composite.[17] Besides clinical studies, numerous in vitro studies have been carried out to measure the fracture strength of FRC FDPs under mechanical loads.[15,18–23] In these investigations, most of the failure types were noted at the interface between the fibre and the resin matrix at the loading point (pontic), and at the connectors. Cohesive delamination within the veneering resin was also found to be the most common failure mode both in in vitro and clinical studies. To the authors' best knowledge, in none of these studies cement type was of focus.

The objectives of this study therefore were to evaluate the clinical performance of indirect, anterior, surface-retained, FRC FDPs bonded using four different resin cements. The null hypothesis tested was that the cement type would not affect the survival of FRC FDPs.

2. Materials and methods

2.1. Study design

The brands, types, manufacturers and chemical compositions of the materials used in this study are listed in Table 1.

2.2. Inclusion and exclusion criteria

As of January 2003, FRC FDPs are offered as alternative to other conventional therapy options at the Department where the study was conducted. Between June-2003 and January-2011, 134 patients aged between 16 and 68 years old (83 females, 51 males, mean age: 42) referred to the Department of Prosthodontics, Dental School Ege University, Izmir (Turkey) from other Departments, received 175 indirect anterior FRC FDPs. Before enrolment in the trial, all patients were provided with a written informed consent form approved by the ethical committee of the university institutional review board (Vote number of the local Ethical Committee no.: 7OM/743; Local ethical registration number: 14/9/4; Clinical Trial Registration Number: **NCT02343796**). Information was given to each patient regarding the alternative treatment options. The inclusion criteria were as follows: all subjects were required to be at least 18 years old, able to read and sign the informed consent document, physically and psychologically able to tolerate conventional restorative procedures, having no active periodontal or pulpal diseases, having no primary caries, not allergic to resin-based materials, not pregnant or nursing, having antagonist teeth opposing the FRC FDP to be restored, willing to return for follow-up examinations as outlined by the investigators. The patients who had more absent teeth than the tooth to be replaced in the rest of the dentition or those having diastemas were not excluded.

2.3. Clinical procedures, restoration design and fabrication

All FDPs replaced one missing tooth and bonded to two adjacent abutment teeth were used for retention. No cantilever FDPs were involved.

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