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Direct resin composite restorations for fractured maxillary teeth and diastema closure: A 7 years retrospective evaluation of survival and influencing factors

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ARTICLE INFO

Article history:

Received 21 November 2016

Received in revised form

12 February 2017

Accepted 13 February 2017

Keywords:

Fracture

Diastema

Resin based composite

USPHS criteria

Longevity

ABSTRACT

Objectives. This retrospective study evaluated the survival rate of anterior direct resin based composite (RBC) build-ups in vital teeth made of microhybrid and nanofill RBC materials and the influence of bruxism, beverage consumption and smoking on the long-term performance of restorations.

Methods. Patients receiving anterior restoration between 2006 and 2011, with the diagnosis of fracture or diastema, were selected. A total of 65 adult patients (mean age: 25.2) with 163 restorations (78 Filtek Supreme XT and 85 Enamel Plus HFO) were evaluated using the USPHS criteria. Data were analyzed with Fisher's Exact Test, Extended Cox-regression analysis and Kaplan–Meier method.

Results. Mean observation period was 7.2 (± 1.4) years and the mean annual failure rate for this period was 1.43%. The reasons of failures included restoration fracture and color mismatch. Nanofill restorations had significantly higher rate of color mismatch ($p = 0.002$), microhybrids more frequently failed in fracture of restoration ($p = 0.034$). The overall difference in potential hazard of using Enamel Plus HFO or Filtek Supreme XT was not significant ($p = 0.704$). Chipping or fracture of the restoration was more frequent in the first year after placement ($p = 0.036$), while beverage consumption was significantly correlated with discoloration of the restorations ($p = 0.005$).

Significance. The application of direct RBC restorations provides an excellent treatment option for fractured teeth and for closing diastemas. The overall survival rate was 88.34% up to 10 years. Microhybrid and nanofill RBC restorations showed similar survival rates, however nanofills discolored at a higher rate, meanwhile chipping of the restoration occurred frequently with microhybrids.

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<http://dx.doi.org/10.1016/j.dental.2017.02.001>

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1. Introduction

Patients suffering from an anterior fracture, attrition, diastema or dental malformation and malposition should be provided with adequate esthetic correction including orthodontic treatment, indirect ceramic or direct resin based composite (RBC) restorations. Recently, with the continuous development of adhesives and RBC technology the state-of-the-art treatment option in operative dentistry for the esthetic improvements of healthy teeth – especially for adolescents and young adults with intact enamel – can be non-invasive or at least minimally invasive [1,2]. Beside the excellent esthetic and mechanical features of the different types of RBCs, the dentist's skill in achieving a natural anatomical shape, surface texture and shade is also a prerequisite for an esthetically pleasing result. Compared to ceramic restorations the direct applications with RBCs have several benefits, such as quickness, cheapness and easy of repair. Currently, RBC is the first choice material to restore anterior and posterior teeth [2,3].

Clinical data on the performance of posterior RBC restorations are indicating low annual failure rates (AFRs) and long-lasting survival [4]. In contrast, despite the general application of RBCs in the anterior region, there is a lack of evidence from clinical trials especially regarding the long term performance of non-carious anterior restorations. These direct tooth-shaped restorations seem to be used increasingly in clinical practice with excellent short-term results [5]. However, a demand for knowledge still exists regarding the potential influencing factors for failure in the long-term. The main reported reasons for failure in posterior teeth are secondary caries and fracture with 70–98% survival rate after 8 and 22 years [6,7]. However, in contrast, caries is not a major cause for failure of anterior restorations [8]. In studies looking at build-ups or direct veneers esthetic failures were more frequently observed, where color alterations, surface staining, and marginal discoloration could negatively influence the patient's perception of the restoration [9,10]. On the other hand, Wolff et al. and van Dijken et al. found that the most frequent threat to direct composite build-ups is the fracture of the RBC [5,11]. In case of chipping, due to the composite's material properties, a simple repair can be performed to extend the life of the original restoration. These unfavorable events could be classified in the evaluation process as survival. The 3–5 years survival of anterior restorations could vary between 79–89% [5,8,12]. However, the potential influence of formulation characteristics of RBC, the size of the build-ups, the patient's factors and operator characteristics remain to be determined, especially in long-term clinical trials. Kubo et al. investigated only the factors associated with the longevity of Class III, IV and V RBC restorations with respect to the gender, age, operator factor, cavity type and retreatment risk [13]. They concluded that operator factor, cavity type and retreatment risk had significant influence on the survival time. Focusing on the material, Gresnigt et al. compared two microhybrid RBC materials in their short-term study and did not find differences in the longevity [9].

There are several research techniques for the assessment of restoration longevity. Among others these include retrospective, prospective studies, randomized controlled clinical

trials, cohort studies and cross-sectional analysis. The biggest challenge for long-term studies is the wear out of the study populations. Retrospective longitudinal studies in particular allow us observation times of more than 10 years, while also enabling us to examine many restorations in a relatively short time [3,6,14,15]. However, retrospective studies do seem to be inferior to prospective ones in certain aspects. In the former design there is an obvious lack of standardization of indication and treatment protocols. Although, if the conditions are set out well at the start, and the number of examining operators are kept to a minimum, the potential of a certain type of restoration can still be reflected [3].

The purpose of this retrospective study was to investigate the failures and estimate the survival of direct RBCs placed for the restoration of fractured maxillary anterior teeth or placed for closing diastemas according to the modified USPHS criteria, in clinical practice using a nanofill RBC and a microhybrid RBC. Factors thought to be associated with failure such as the size of the build-up, bruxism, dietary habits and smoking were also examined for up to ten years.

2. Material and methods

2.1. Study design and participants

The database with clinical records from the Operative Dentistry Department at the University of Pécs was used in the present evaluation. From this database, all patients who had received direct RBC restoration in the maxillary anterior teeth by the first author (E.L.) for fracture or diastema closure (including peg-shaped lateral incisors) were selected for this retrospective analysis. The study protocol was approved by the Regional Research Ethics Committee of University of Pécs (3410.1/2009). All patients were contacted by phone or mail. Those patients who were able to participate in the study, signed a written, informed consent prior to the start of the clinical evaluation.

2.2. Inclusion and exclusion criteria

For this retrospective study, a total of 65 patients with ages ranging from 18 and 58 years old (25 males and 40 females, mean age: 25.2 at the time of restoration placement) were selected according to pre-determined inclusion criteria from the registers of a Hungarian clinical practice (University of Pécs), from June 2006 to December 2011, securing a minimum observation period of 5 years and the longest one of 10 years. The selected patients received a total of 163 direct RBC build-ups in their vital maxillary teeth. 70 central incisors and 22 lateral incisors were restored with the indication of fracture. Diastema closure was performed in 32 cases in central incisors, 31 cases in lateral incisors (including peg-shaped lateral incisors, $n=5$) and 8 cases in canine. Information was given to each participants regarding the alternative treatment options. The inclusion criteria employed comprised of the following: all participants were at least 18 years old, able to read and sign the informed consent document, physically and psychologically able to tolerate the procedure. Furthermore, patients who were selected for the

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