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Clinical effectiveness of direct anterior restorations—A meta-analysis

Siegward D. Heintze[a,*], *Valentin Rousson*[b], *Reinhard Hickel*[c]

[a] *R&D, Ivoclar Vivadent AG, Schaan, Liechtenstein*
[b] *Biostatistics Unit, Institute for Social and Preventive Medicine, University of Lausanne, Switzerland*
[c] *Department of Operative Dentistry and Periodontology, Ludwig-Maximilian-University, Munich, Germany*

ARTICLE INFO

Article history:
Received 1 August 2013
Received in revised form
8 April 2014
Accepted 28 January 2015

Keywords:
Anterior restorations
Class III, Class IV
Composite resin
Adhesive system
Color
Fracture
Marginal integrity

ABSTRACT

Objectives. This is the first meta-analysis on the efficacy of composite resin restorations in anterior teeth. The objective of the present meta-analysis was to verify whether specific material classes, tooth conditioning methods and operational procedures influence the result for Class III and Class IV restorations.

Material and methods. The database SCOPUS and PubMed were searched for clinical trials on anterior resin composites without restricting the search to the year of publication. The inclusion criteria were: (1) prospective clinical trial with at least 2 years of observation; (2) minimal number of restorations at last recall = 20; (3) report on drop-out rate; (4) report of operative technique and materials used in the trial, and (5) utilization of Ryge or modified Ryge evaluation criteria. For the statistical analysis, a linear mixed model was used with random effects to account for the heterogeneity between the studies. *p*-Values smaller than 0.05 were considered to be significant.

Results. Of the 84 clinical trials, 21 studies met the inclusion criteria, 14 of them for Class III restorations, 6 for Class IV restorations and 1 for closure of diastemata; the latter was included in the Class IV group. Twelve of the 21 studies started before 1991 and 18 before 2001. The estimated median overall success rate (without replacement) after 10 years for Class III composite resin restorations was 95% and for Class IV restorations 90%. The main reason for the replacement of Class IV restorations was bulk fractures, which occurred significantly more frequently with microfilled composites than with hybrid and macrofilled composites. Caries adjacent to restorations was infrequent in most studies and accounted only for about 2.5% of all replaced restorations after 10 years irrespective of the cavity class. Class III restorations with glass ionomer derivates suffered significantly more loss of anatomical form than did fillings with other types of material. When the enamel was acid-etched and no bonding agent was applied, significantly more restorations showed marginal staining and detectable margins compared to enamel etching with enamel bonding or the total etch technique; fillings with self-etching systems were in between of these two outcome variables. Bevelling of the enamel was associated with a significantly reduced deterioration of

* Corresponding author at: Ivoclar Vivadent, Bendererstr. 2, 9494 Schaan, Liechtenstein. Tel.: +423 235 3570; fax: +423 233 1279.
E-mail address: siegward.heintze@ivoclarvivadent.com (S.D. Heintze).

http://dx.doi.org/10.1016/j.dental.2015.01.015

the anatomical form compared to no bevelling but not with less marginal staining or less detectable margins. The type of isolation (absolute/relative) had a statistically significant influence on marginal caries which, however, might be a random finding.

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1. Introduction

Perfect anterior restorations act as an advertisement for the skills of the dental professional. Most operative interventions in anterior teeth are accomplished with the direct placement of composite resins. The skill of the dentist in achieving a natural anatomical shape and color match with the adjacent teeth are prerequisites to achieving a pleasing aesthetic result, which can also be assessed easily by the patients themselves. Type of composite resin, methods and materials to condition the tooth structure (enamel etching, self-etching, no etching) as well as the operative procedure (bevelling of enamel margin, rubber dam application) may also influence both the aesthetic results and the longevity of the restoration.

Before the development of composite resins and the acid-etch technique of the enamel, carious lesions in anterior teeth were mainly restored with silicate cement, which required a retentive preparation pattern [1]. Restorations that involve the proximal part of an anterior tooth but not the incisal edge are defined as Class III restorations.

In the early days, the building up of fractured teeth was only possible with indirect restorations, such as full-coverage crowns, because bonding to the remaining tooth substance had not yet been established as an operative procedure. Already in the nineteen-fifties, the enamel etch technique with phosphoric acid was developed by Buonocore [2]. However, it took about 20 years until this technique has been introduced into clinical dentistry. This technique made it possible to directly restore fractured anterior teeth with composite resin, to close diastemata or to build up worn teeth. Restorations that involve a part of the incisal edge are defined as Class IV restorations.

At that time, there was a dispute as to whether it is necessary to place an unfilled resin bonding material on the etched enamel or whether high-viscosity resin composites could be placed directly on the etched enamel. The operative procedures have been gradually simplified and the materials improved since then. First, the application times of both enamel etching and rinsing were reduced from 60 to 30 s [3], dentin bonding agents made liners superfluous and increased the bonding strength to the tooth structure [4]. Then, self-etching adhesive systems were introduced [5]. Capable of establishing a bond to both the enamel and dentin, these materials streamlined the operative procedure because they eliminated the need for a separate rinsing step.

Most contemporary dental composite resins still contain a monomer which was already developed in the late 1950s of the last century by M. Bowen [6]: it is called Bisphenol-A glycidylmethacrylate or simply Bis-GMA or Bowen's resin Microfilled composites and later hybrid and nano-hybrid composites replaced the macrofilled composites, which were the first dental resins on the market [7]. Polymerization curing lights were first introduced at the end of 1970s of last century [8]. They allowed these materials to be cured on demand, which facilitated the customization of anterior restorations, because they could be built up step-by-step with several layers that have different optical properties.

With the reduction of caries prevalence in most countries, the prevalence of Class III restorations due to proximal caries has also dropped. However the prevalence of traumatic injuries to anterior teeth has significantly increased over the last 20 years due to an increase in sports activities undertaken during leisure time. In some countries, particularly in Scandinavia, children and adolescents have nowadays more teeth damaged by traumatic injuries than by caries [9]. The restoration of fractured teeth (Class IV) with composite is usually the first treatment option.