

## Composite resin repair: systematic review

### Reparação em resina composta: revisão sistemática

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**Resumo | Introdução:** A substituição total de restaurações de resina composta é uma das técnicas mais utilizadas por cirurgiões dentistas quando estas restaurações apresentam alguma falha. Essa técnica amplia o preparo cavitário, removendo tecido dentário sadio, podendo gerar danos pulpares. A reparação de resina composta substitui parcialmente a restauração preservando estrutura dental e o substrato remanescente de resina composta. **Objetivo:** Realizar uma revisão sistemática por meio de estudos que descrevessem a eficácia clínica e laboratorial da reparação em restaurações de resina composta defeituosas. **Método:** Como base para a pesquisa, foram acessados os bancos de dados PubMed, Scopus, BVS e SciELO, os descritores selecionados através do DesC e MeSH foram, Resinas compostas, Desgaste de restauração dentária, Falha de restauração dentária, Reparação de restauração dentária. **Resultados:** Foram incluídos todos os artigos que abordassem sobre a técnica de reparação. **Conclusão:** Existem poucas evidências científicas que mostrem o sucesso e vantagens desse método sobre a substituição total, porém os estudos analisados já apresentam bons resultados.

**Descritores:** Resinas compostas. Desgaste de restauração dentária. Falha de restauração dentária. Reparação de restauração dentária.

**Abstract |** The total replacement of the composite resin restorations is one of the most used techniques by dentist surgeons when these restorations show any flaw. This technique expands the cavity preparation by removing healthy dental tissue and this can cause possible damage to the pulp. The composite resin repair partially replaces a restoration by preserving the dental structure and the remaining defective composite resin substratum. **Objective:** Realizing a systematic review by studies which describe the clinical and laboratorial effectiveness of the repair of defective composite resin restorations. **Method:** This research is based on the information gathered on the database of PubMed, Scopus, BVS and SciELO. The chosen keywords selected by DesC and MeSH are Composite Resins, Dental restoration wear, Dental restoration failure e Dental restoration repair. **Results:** It was included all the articles that would approach these techniques of reparation. **Conclusion:** There are few scientific evidences which show the success and the advantages of this method about total replacement, but the analyzed studies have already shown good results.

**Keyword:** Composite Resins. Dental restoration wear. Dental restoration failure. Dental restoration repair.

## Introduction

The media-disclosed aesthetics has increased the demand for aesthetic procedures. Resin is a material of excellent aesthetic quality, but with limited longevity, when compared with other materials<sup>1</sup>, such as ceramics. The composite resin is considered a standard material by several dentists, because it has several advantages, such as good aesthetics quality, conservative preparation and good resistance<sup>2-4</sup>. Nevertheless, the longevity of all materials is limited, with a mean failure of 2.2%<sup>5-6</sup>.

Marginal deficiencies, fracture and wear may lead to secondary caries formation or tooth sensitivity<sup>7-8,6</sup>. The traditional treatment for these defects is the total replacement of the restorations, (50-71% of a dentist's work is to replace totally a restoration) (2,5,8-9), this procedure expands the cavity preparation by removing the dental tissue and thus, causing pulp damage<sup>10-13</sup>.

Marginal sealing, remodeling, and repair are feasible alternatives for defective restoration replacement<sup>10,12,14-15</sup>. Repair is the partial replacement of a restoration, preserving a portion of the restoration that does not present clinical or radiographic evidence of failure. This technique has as advantage being conservative, economical, fast, less traumatic, and sometimes, free from local anesthesia<sup>1</sup>.

There are evidences that composite resin restorations that exhibit marginal discoloration, surface wear or fracture do not require total replacement. In these cases, they can be repaired using composite resin through a surface treatment and application of suitable adhesive systems<sup>2,15-18</sup>.

A study by Blum et al. (2011) describes two techniques of surface treatment: air abrasion based on silica coating (which has as an advantage an increased resistance of the chemical bond of the composite resin repair to the composite resin substrate) and composite repair based on conventional adhesion systems (a technique that is considered simple because it is usually used for conventional composite resin restorations).

Currently, the total replacement is the technique of choice by most dentists during restorations presenting failure. However, some studies present the repair technique as a possibility for replacement, which might prevent the patient from undergoing a more harmful procedure, reducing thus, the risk of loss of healthy dental tissue and pulpal damage.

The table below shows when repair or replace should be used according to clinical problems, marginal defects, surface problems, fractures and loss of mass.

**Table 1.** Clinical situations and recommendations for choosing between repair and replacement

Clinical situation	Repair	Replacement
<b>1. Marginal problems</b>		
<b>Marginal staining</b>	-Clear and localized marginal stain	- Deep, not accessible marginal stain
<b>Marginal adaptation</b>	- Gap > 250 µm or dentin / base exposure - Severe opening or marginal fracture (tooth or restorative material) - Major irregularities or steps (negative)	- The restoration is loose (completely or partially), but continues at the application site - Major gaps or generalized irregularities
<b>Caries adjacent to restoration (secondary caries)</b>	Severe marginal demineralization or caries with cavitation and suspected but localized and accessible debilitating caries	Deep cavities or exposed dentin that is not accessible for repair
<b>2. Surface Problems</b>		
<b>Surface shine</b>	Empty or rough surface, not disguised by the saliva film, simple polishing is not enough	Surface with unacceptable and completely rough plate retention
<b>Anatomical aesthetic shape</b>	The shape is affected and aesthetically unacceptable Intervention / repair is necessary	The shape is unsatisfactory and / or lost. Repair is not feasible or unreasonable
<b>Approximate anatomical shape</b>	The contact point is very weak and susceptible to damage caused by food impact or improper contouring	Very weak contact point and / or damage caused by food impact with non-viable / possible repair
<b>Occlusal contour and wear</b>	Wear considerably exceeds normal enamel wear; the occlusal contact points are lost	Generalized excessive wear, therefore, repair is not feasible
<b>3. Fractures and complete loss</b>		
<b>Closure of the access cavity after endodontic treatment</b>	The remaining restoration (larger fill or crown) is sufficient	The remaining restoration is insufficient, repair is infeasible
<b>Fracture of the restorative material</b>	- Pieces of the fracture that damage marginal quality, or proximal contact, or contour -Mass fractures with partial loss (less than half) of the restoration	Complete (or partial) loss of the restoration and / or multiple fractures
<b>Integrity of the tooth (cleft enamel, dental fractures)</b>	-Major gaps > 250 µm, probe penetration - Large enamel splinters or wall fracture -Surface fractures (which are more accessible for repair)	Large tip or tooth fracture
<b>Point of view of the patient</b>	Desire to improve aesthetics or function, for example: tongue irritation and remodeling of the anatomical shape, impossible / insufficient remodeling	Completely unsatisfied and / or with adverse effects, including pain

SOURCE: (HICKEL *et al.*, 2013).

The acronym PICO (P- defective composite resin restorations, I- repair technique, C- replacement of defective restorations, O- repair of composite resin restorations are successful) was used to present the components related to the review, structuring the following guiding question: Is composite resin repair effective on teeth that present defects in composite resin restoration? The aim of this study was to conduct a systematic review through studies describing the clinical and laboratory efficacy of repair in defective composite resin restorations.

### Methodology

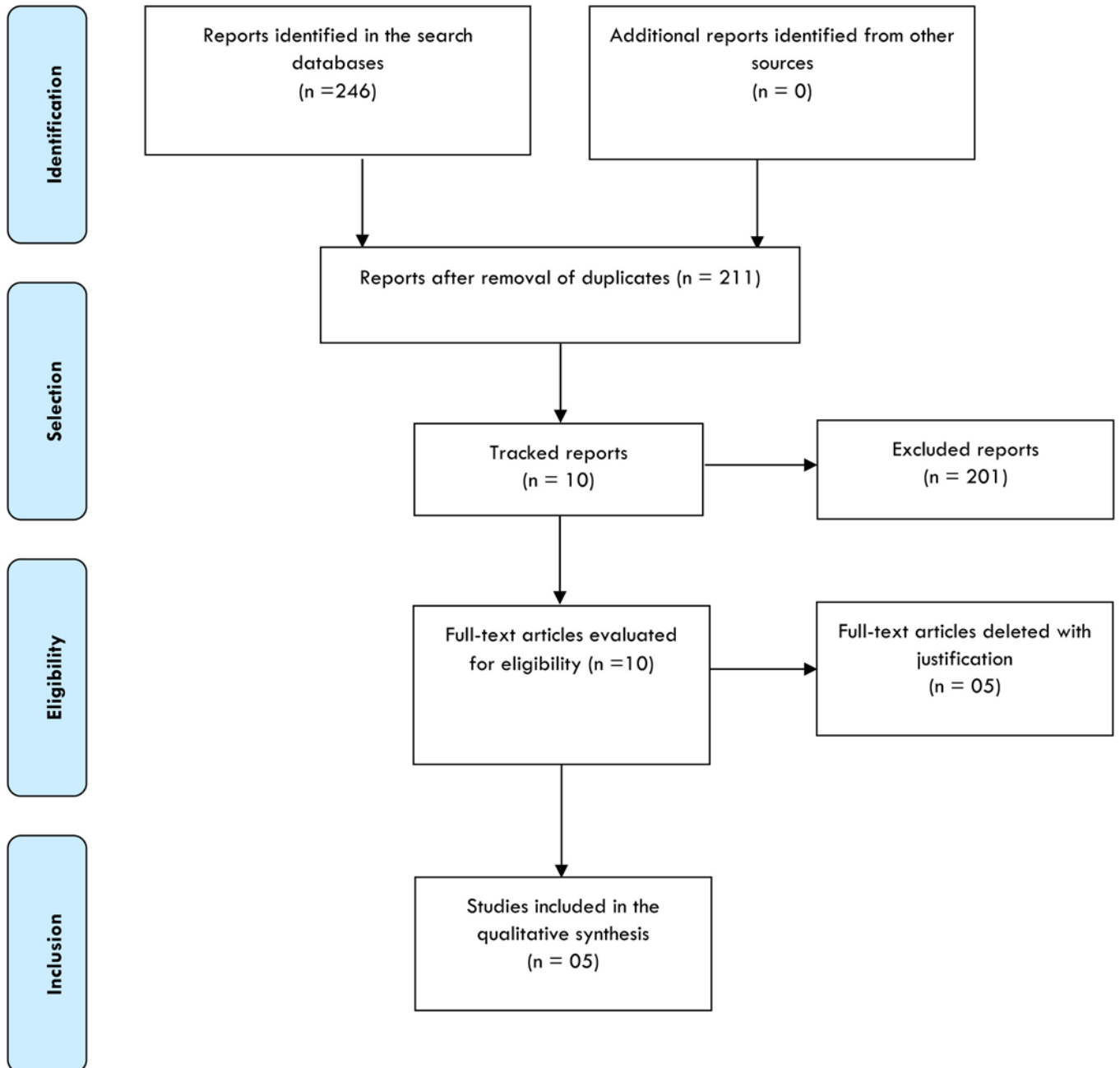


Figure 1. PRISMA flowchart demonstrating the methodology applied to the selected articles. Table located below the Methodology. PRISMA 2009 Flow Diagram.

The present study is characterized as a systematic review, which was carried out according to the PRISMA protocol (PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of studies). This protocol can be accessed at the following link: [http://prisma-statement.org/documents / PRISMA%202009%20checklist.pdf](http://prisma-statement.org/documents/PRISMA%202009%20checklist.pdf). The items 13,14,16,21,22, and 23 were excluded, because this study did not use a meta-analysis.

The acronym PICO was used as a basic element for word crossing, in which: P = population (population or clinical situation), I = intervention (intervention), C = comparison (comparison) and O: outcome. The Boolean operator AND was used to cross the descriptors.

This review addressed every article discussing the subject “repair” in composite resin after its creation as a technique. The survey was carried out from 08/18/2016 to 09/14/2016, without distinction of languages, on the following databases: BVS, SCIELO, SCOPUS AND PUBMED. On the database SCIELO the descriptors were placed separately, without the “AND” combination (the AND operand was removed due to lack of articles found when it was used). The descriptors were selected through a consultation with the Descriptors in Health Science (DeSC) and Medical Subjective Headings (MeSH).

The following descriptors were used: Composite Resins, Dental Restoration Wear, Dental Restoration Failure and Dental Restoration Repair.

The research included the articles that denoting “repair” in composite resin, performed both in vitro and /or in vivo. The exclusion criteria were: literature / systematic reviews, letters, prefaces and comments. The screening (reading of titles and abstracts) was performed according to the inclusion criteria by two reviewers simultaneously. Then, the articles were read completely to confirm they inclusion in the study. The articles included were purchased from the VHL (4 articles) and SCIELO (1 article) databases.

## Results

From the search in the electronic databases, this work selected 16 articles from VHL, 195 from SCIELO, 19 from SCOPUS and 16 from PUBMED, totalizing 246 articles. Then, duplicates were removed, leaving 211 articles. In the screening process (reading of title and abstract), 10 articles were selected for complete reading. According to the inclusion criteria, 5 articles were chosen for the review. The analysis of the articles indicates that the repair of defective composite resin restorations is an effective technique in dental procedures.

**Table 2.** Placement of the studied authors in relation to the technique for composite resin repair. Table located below the Results.

<b>Authors</b>	<b>Type of study</b>	<b>Sample</b>	<b>Main Conclusions</b>
Gordan <i>et al.</i> (2009)	Prospective longitudinal study.	Thirty-seven patients (19 women, 18 men) aged 27 to 78 participated in the study.	The results indicated that marginal discoloration was the main cause for defective restorations. Among the techniques presented by the authors, the percentage of failure for repair in 7 years was 0%.
Karaman AND Gönülol (2014)	Clinical Laboratory Study	Thirty cylindrical specimens of composite resin (Filtek Silorane, Filtek Z550 (3M ESPE), Gradia Direct Anterior (GC), and Posterior Aelite (BISCO)) were prepared and cured by QTH light radiation with a light curing unit (LCU).	The authors concluded that the anterior composites based on dimethyl acrylate can be repaired with different light sources.
Lynch <i>et al.</i> (2012)	Field Research	67 colleges of dentistry in the United States of America and Canada.	88% of colleges taught repairing defective composite resin-based restorations. However, although repair of resin-based composite restorations was found to be in the course plan of most dental schools, students at some of these colleges have not gained experience in the treatment of minimally invasive resin composite restorations through repair procedures.
Gordan <i>et al.</i> (2012)	Cross-sectional study	9,484 restorations of 7,502 patients in 197 practices	Secondary caries was the most common cause for repair or replacement. The authors concluded that dentists were more likely to replace than repair.
Fernández <i>et al.</i> (2011)	Prospective clinical trial	A group of 66 patients, aged between 18 and 80 years	The results of this clinical study accepted the hypothesis that alternative treatments of defective restorations increased the longevity of the restorations with a minimum number of interventions.

## Discussion

Evidences show that the repair of composite resin restorations is a conservative technique and may be an alternative to total replacement<sup>2,10</sup>. The clinical examination is essential in the decision process, which must consider the following parameters: marginal adaptation, anatomical shape, surface roughness, marginal and interfacial coloration, secondary caries and brightness. During the visual inspection, the dentist can use dental floss, exploratory probe and carbon paper<sup>2</sup>.

Regarding defective restorations, the diagnosis is mainly performed based on the presence of marginal discoloration and secondary caries<sup>2,9</sup>. Composite resin repair is especially indicated for secondary caries, fracture, tenderness, pain and discoloration of the restoration<sup>20</sup>, which should be analyzed both clinically and radiographically. Thus, when an adequate repair decision is made, the dental tissue is preserved, and the working time is decreased<sup>2,10,16,20</sup>.

In a longitudinal cut study with dentistry students of the third and fourth year (under faculty supervision), Gordan et al. (2009)<sup>2</sup> recorded that 88 defective restorations were diagnosed and corrected through repair, sealant, and retouching. The patients were followed up after 6 months, 1 year, 2 years and 7 years, with 0% failure in the repair in 7 years, demonstrating that when compared to replacement, repair is a viable and lasting technique.

Lynch et al. (2012)<sup>16</sup> performed a study on composite resin repair teaching with 67 schools in the United States of America and Canada, which was answered by 72% of the institutions. They demonstrated that 88% of the schools included this technique in their curricula and 13% included only the didactic teaching of this technique. The practice associated with teaching is important because the repair should be taught in view that current dentistry seeks the preservation of dental tissue.

Karaman and Gönülol (2014)<sup>8</sup> conducted a study with the objective of examining the effect of light sources on the adhesion strength to the micro-shear of different composite resins repaired with the same substrate. The authors concluded that the dimethacrylate-based composites can be repaired

with different light sources and that in the repair of the silorane-based composite, the Xenon plasma arc light source (PAC) presented the lowest values of bond strength. Finally, they concluded that the best options for this compound are the sources of light quartz-tungsten-halogen (QTH) or light emitted by diodes (LED).

Replacement of the restoration, besides generating sensitivity, can cause injury to the pulp. Thus, for small secondary caries, marginal discolorations and fractures, repair is a viable alternative. However, Gordan et al. (2012)<sup>20</sup> demonstrated that dentists were more likely to replace than repair.

Gordan et al. (2009)<sup>2</sup> describes that the repair technique should be performed as follows: 1-removal of the defective part with a round carbide bit; 2-attack with 35% phosphoric acid; 3-application of an adhesive system; 4-application of the restorative material (composite resin).

In a study by Fernández et al.<sup>2011</sup>, 66 patients with deficient restorations were separated into 5 treatment groups: marginal sealing, remodeling, repair, replacement and non-treatment. The authors concluded that repair is an effective procedure with minimal intervention. In synthesis, repair is simple, fast and of low-cost compared to most other techniques.

## Conclusion

The current Dentistry seeks to employ minimally invasive techniques, to preserve the dental structure. In the process of replacement, a certain amount of dental tissue can be removed, which may cause pulp damage and dentin sensitivity. Evidences have shown that restoration in composite resin is indicated for in the cases of small marginal discolorations, fractures and secondary caries because this procedure is simple, lasting, minimally invasive, fast and of low-cost. In conclusion, composite resin repair is effective, although further studies are required to fully elucidate the characteristics of the use of this technique in dental procedures.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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