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Review article

Longevity of defective direct restorations treated by minimally invasive techniques or complete replacement in permanent teeth: A systematic review

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ABSTRACT

Objectives: This systematic review aimed to verify if there is difference in the longevity of minimally invasive techniques compared to the complete replacement for the treatment of defective direct restorations in permanent teeth.

Data: The data included randomized controlled clinical trials comparing the clinical performance of defective dental restorations treated by a complete replacement technique or minimally invasive techniques on permanent teeth. Evaluation of the risk of bias was performed using the Cochrane Collaboration common scheme for bias and the evidence was qualified using the GRADE tool.

Source: A comprehensive search was performed in the electronic databases: PubMed, Scopus, ISI Web of Science, The Cochrane Library, LILACS, BBO, SIGLE, followed by manual search in the reference lists of the included studies, without any restrictions.

Study selection: From 5554 retrieved studies, 10 met the eligibility criteria and were submitted to data extraction and quality assessment. The repair technique presented similar results to replacement and superior results when compared to sealing. In addition, refurbishment demonstrated to be a useful treatment for localized anatomical form defects. All the studies presented low risk of bias and high quality evidence for repair and refurbishment and moderate for the sealing technique.

Conclusions: The direct restorations treated by the repair, seal and refurbishment techniques did not present a significant difference in clinical longevity in comparison to the replacement technique in permanent teeth with overall moderate quality of evidence.

Clinical significance: The present findings demonstrated that the best treatment for defective restorations is conservative management. The evidence demonstrated here helps and encourages clinicians during the decision-making process. Moreover, it suggests not replacing imperfect restorations, but to managing them in a minimally invasive way, allowing the structure to be preserved.

1. Introduction

Restoration replacement is widely used in contemporary dentistry for the treatment of defective restorations in permanent teeth [1]. This technique is characterized by the complete removal of the direct restoration and replacement with restorative material [2–5]. Recently, minimally invasive strategies such as repair, sealing or refurbishment have been proposed as alternatives to the replacement technique to preserve health tissue [2–4,6,7].

Traditionally, the choice between the use of replacement or minimally invasive alternative techniques for the treatment of direct restoration is based on the type and location of the defect [2,7]. The

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Table 1
Search strategy in the databases.

Database	Search strategy	Findings
Pubmed	**#1** Dental Restoration Failure[mesh] or Restorations Failure Dental[tiab] or Refurbishment[tiab] or Restoration defect[tiab] or Marginal discrepancies[tiab] or Deterioration margins[tiab] or Dental Restoration Repair[mesh] or Repair Dental[tiab] or Repair Tooth[tiab] or Repair [tiab] or Restoration repair[tiab] or Self Curing Dental Resins[mesh])	277,186
	#2 (Pit and Fissure Sealants[mesh] Fissure Pit Sealant*[tiab] or Seal*[Tiab] or Liners[tiab] or Flowable light-curing[tiab] or Self priming resin bonding[tiab] or Filtek Supreme 3 M ESPE[tiab])	39,270
	# 1 and # 2	2,723
Scopus	**#1** ("Restorations Failure Dental" or Refurbishment or "Restoration defect" or "Marginal discrepancies" or "Deterioration margins" or "Dental Restoration Repair" or "Repair Dental" or Repair or "Restoration Repair" or "Self-Curing Dental Resins")	444,549
	#2 ("Fissure Pit Sealants" OR sealants OR liners OR "Flowable light curing" OR "Self priming resin bonding" OR "Filtek Supreme 3 M ESPE")	53,202
	# 1 and # 2	1,066
Web of Science	**#1** ("Restorations Failure Dental" or Refurbishment or "Restoration defect" or "Marginal discrepancies" or "Deterioration margins" or "Dental Restoration Repair" or "Repair Dental" or Repair or "Restoration Repair" or "Self-Curing Dental Resins")	1415
	#2 ("Fissure Pit Sealants" OR sealants OR liners OR "Flowable light curing" OR "Self priming resin bonding" OR "Filtek Supreme 3 M ESPE")	22,782
	#1 and #2	994
Cochrane	**#1** Mesh: Dental Restoration Failure	14,874
	#2 Tiab: ("Restorations Failure Dental" or Refurbishment or "Restoration defect" or Refurbishment or "Marginal discrepancies" or "Margins Deterioration")	
	#3 (#1 or #2) = 1305	
	#4 Mesh: Dental Restoration Repair = 112	
	#5 Tiab: ("Repair Dental" or "Repair Tooth" or "Repair Teeth" or Repair or "Restoration repair") = 10,529	
	#6 (#4 or #5) = 10,529	
	#7 Mesh: Self-Curing of Dental Resins = 47	
	#8 Mesh: Dental Restoration permanent = 1567	
	#9 Mesh: Retreatment = 2068	
	#10 Tiab: Retreatment = 2068	
	#11 (#9 or #10) = 2068	
	#12 (#3 or #6 or #7 or #8 or #11) = 14,874	
	#13 Mesh: "Pit and Fissure Sealants" = 510	9181
	#14 Tiab: "Fissure Pit Sealant*" or Seal* or Liners or "Flowable light-curing"or "Self priming resin bonding" or "Filtek Supreme 3 M ESPE" = 9181	
	#15 (#13 or #14) = 9181	
	#12 and #15	1,047
BVS (Lilacs and BBO)	**#1** (mh:"dental restoration failure" or "restoration failure dental" or "falha restauração" or "repair dental" or "reparação restauração dentária" or repair or reparo or "restoration repair" or "reparação restauração dentária")	299,315
	#2 (mh:"pit and fissure sealants" or "fissure pit sealant" or "selantes fossas e fissuras" or sealant* or selantes or liners)	26,174
	#1 and #2	62
Open Gray	**#1** dental restoration failure or restoration failure dental or falha restauração or repair dental or reparação restauração dentária or repair or reparo or restoration repair or reparação restauração dentária	0
	#2 pit and fissure sealants or fissure pit sealant or selantes fossas e fissuras or sealant* or selantes or liners	0
	#1 and #2	0

substitution of direct composite resins requires a greater consumption of clinical time and unnecessary removal of healthy dental structure, which may result in indirect restorations being needed or even irreversible lesions to the dental pulp [3,8]. Advances in the knowledge of dental materials have led to the development of minimally invasive dentistry [4,9,10].

In this sense, the Ryge Clinical Criteria [11] are useful to monitor and judge if the restoration defect is eligible to be repaired or replaced. Previous studies [2–4,6,7] reported that the replacement technique is indicated for the treatment of direct restorations classified with the Charlie score, while minimally invasive alternative techniques are indicated for Alpha and Bravo scores [2,7]. Considering the Alpha and Bravo scores of the Ryge Clinical Criteria, if the defective area is superficial, the repair, sealing or finishing are considered as options for minimally invasive protective techniques. When the marginal defect is extensive, the repair also constitutes an alternative treatment to the replacement [8].

Clinical trials have demonstrated the good clinical performance of minimally invasive techniques, but many clinicians have been reluctant to incorporate this practice in routine care [2,5–7,12]. Despite the numerous advantages of these alternative techniques, there is still no robust scientific evidence based on systematic reviews that supports its use over replacement of defective restorations. Thus, the present systematic review aimed to answer the following focused question: "Is there a difference in the longevity of minimally invasive techniques compared to the complete replacement for the treatment of defective direct restorations in permanent teeth?"

2. Material and methods

2.1. Protocol registration

This systematic review was recorded in the PROSPERO database under the number CRD42017072510 (http://www.crd.york.ac.uk/CRDWeb/) and its elaboration followed the recommendations of the guide 'Preferred reporting items of systematic review and meta-analysis protocols' (PRISMA-P) [13].

2.2. Search strategy

The search strategy of the literature was developed using a combination of MeSH terms with the free terms related to the theme, and also more cited in the published literature related to the replacement technique or alternative techniques for the treatment of direct restorations in permanent teeth. The search process was performed by one researcher (BMCM) under the guidance of a librarian with experience in systematic reviews (DTPF). The search strategies were adapted according to the requirement of each base researched and are individually described (Table 1). The terms were searched for in the title and abstract fields without applying any kind of filter or threshold. The last update was made on September 25, 2017 and the following electronic databases were searched: MEDLINE via PubMed, Cochrane Library, Web of Science, Scopus, BVS - Latin American and Caribbean Literature in Health Sciences (LILACS) and the Brazilian Library of Dentistry (BBO) and Open Gray (Table 1).