Comunicação Científica e Técnica em Odontologia 4

Emanuela Carla dos Santos
(Organizadora)

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APRESENTAÇÃO

A inovação é o combustível do crescimento profissional em todas as áreas, mesmo na mais tradicional até a área mais tecnológica. A Odontologia é a ciência que agrega os princípios técnicos tradicionais, como por exemplo, aqueles postulados por Greene Vardiman Black, às mais avançadas tecnologias, como escâneres intraorais e impressoras 3D capazes de produzirem peças anatomicamente perfeitas, específicas para cada caso.

Pensando na propagação de conhecimento dentro das mais variadas áreas de atuação do Cirurgião Dentista, a Atena Editora disponibiliza mais um compilado de artigos, organizados em dois volumes, com a temática Comunicação Técnica e Científica em Odontologia.

Espero que a leitura do conteúdo deste E-book proporcione ampliação de conhecimentos e que também provoque curiosidade em você, leitor, pois são os novos questionamentos que impulsionam novas descobertas.

Ótima leitura.

Emanuela C. dos Santos

SUMÁRIO

CAPÍTULO 6

TREATMENT SUCCESS AND CARIES LESION PROGRESSION AFTER SELECTIVE CARIES REMOVAL TECHNIQUE AND RESTORATIVE TREATMENT: A SYSTEMATIC REVIEW

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ABSTRACT: Objectives: To conduct a systematic review of literature to evaluate whether selective removal of carious dentin prior to restorative treatments paralyzes the progression of lesions by evaluating the changes in the number of cariogenic microorganisms and clinical characteristics of the remaining dentin, as well as the success of the restorative treatments. Materials and methods: PIO question was defined and the search for scientific papers was performed on the following databases: PubMed, Scopus, Web of Science, Lilacs and Open Gray. After excluding duplicates and studies not referring to the PIO question, 19 scientific papers were selected by two independent researchers (MS and CI) by title and abstract and 7 were excluded after complete reading. Results: literature review showed that, in all studies analyzed (n = 12), the selective caries removal technique results in a decrease in the number of viable bacteria and S. mutans in the remaining dentin compared to baseline and similar when compared to total removal. For bacteria from the Lactobacillus spp group, a reduction was observed in 83% of the analyzed studies (n = 10). Regarding clinical parameters, it was observed in 6 studies that the remaining dentin suffers color and consistency changes after selective caries removal technique and changes from yellowish color and softened consistency to a darker and harder tissue

(67% and 83% of the studies, respectively), suggesting inhibition of the caries lesions progression. Conclusion: Selective caries removal is an effective option for stopping the progression of deep caries lesions. However, the success of the restorative treatment could not be evaluated in this review due to the lack of studies evaluating the longevity of restorative procedures.
KEYWORDS: Selective caries removal; Dental caries.

SUCESSO DO TRATAMENTO E PROGRESSÃO DE LESÕES DE CÁRIE APÓS REMOÇÃO SELETIVA E TRATAMENTO RESTAURADOR: REVISÃO SISTEMÁTICA

RESUMO: Objetivo: realizar uma revisão sistemática da literatura para avaliar se a remoção seletiva de dentina cariada antes de tratamentos restauradores paralisa a progressão das lesões resultando em alterações no número de microrganismos cariogênicos e nas características clínicas da dentina remanescente, bem como o sucesso desses tratamentos restauradores. Materiais e métodos: A pergunta PIO foi definida e a busca de artigos científicos foi realizada nas seguintes bases: PubMed, Scopus, Web of Science, Lilacs e Open Grey. Após exclusão de duplicatas e estudos não referentes à pergunta PIO, 19 artigos científicos foram selecionados por dois pesquisadores independentes (MS e CI) a partir do título e resumo, sendo 7 excluídos após a leitura completa. Resultados: As análises da literatura demonstraram que, em todos os estudos analisados (n=12), o processo de remoção seletiva resulta em diminuição no número de bactérias viáveis e S. mutans na dentina remanescente em comparação com o baseline e similar quando comparado a remoção total. Já para o as bactérias do grupo Lactobacillus spp, uma redução foi observada em 83% dos estudos analisados (n=10). Em relação aos parâmetros clínicos, foi observado, em 6 estudos, que a dentina remanescente sofre alterações de cor e consistência após a remoção seletiva do tecido cariado, passando de amarelado e amolecido para uma cor mais escura e de consistência mais dura (67% e 83% dos estudos, respectivamente), o que sugere inibição da progressão das lesões de cárie. Conclusão: a remoção seletiva de cárie é uma opção eficaz para paralisação da progressão das lesões de cárie profundas. Entretanto, o sucesso do tratamento restaurador não pôde ser avaliado nessa revisão devido à falta de estudos que avaliam a longevidade dos procedimentos restauradores.
PALAVRAS-CHAVE: Remoção seletiva de cárie; Cárie dental.

INTRODUCTION

Dental caries is a dynamic process that occurs when an imbalance between the teeth mineral and the fluid of the adjacent biofilm happens (Fejerskov and Nyvad, 2003). In its early stages, caries is perceived as an opaque white spot lesion due to the partial dissolution of hydroxyapatite crystals, causing microporosities in dental surface that are filled with water or air, altering the refractive index of light (Thylstrup and Fejerskov, 1995). When it is not treated the progression of the lesion continues

until it reaches deep teeth layers. In its advanced state, the restorative procedure is indispensable to halt caries process and to restore teeth shape and function. However, the complete removal of decayed tissue in deep carious lesions leads to a high risk of pulpal exposure (Leksell et al., 1996), making this procedure a challenge to clinicians.

In order to avoid pulp exposure and maximize the permanence of restored teeth in oral cavity, minimally invasive technique such as selective caries removal has been widely used as a new approach to deep caries lesions management. The selective caries removal technique consists of removing all infected dentin from teeth circundant walls and to leave soft dentine over pulpal wall to preserve pulpal health (Schwendicke et al., 2016). The remaining dentin, although no longer infected, is still contaminated with microorganisms and often presents a yellowish color and a soft consistency, which may lead clinicians to believe that remaining affected dentin would interfere with the success of dental restorations after a long period of time. This concern is partially related to the number of microorganisms left beneath restoration.

Many studies have shown that selective caries removal is effective in reducing dentin cariogenic microorganisms as well as in improving clinical aspects such as color and consistency (Bitello-Firmino et al., 2018, Maltz et al., 2002). However, little is yet understood about this technique, how it affects the clinical parameters of caries and the restorative success after selective removal of caries lesions.

OBJECTIVES

The aims of the present study were to evaluate the caries lesions progression, through bacterial counting and clinical parameters, and success of restorative treatments after selective caries removal technique through a systematic review of literature.

MATERIALS AND METHODS

Defining PIO question

In this study, PIO question format was used as a search strategy and was defined before starting databases search (table 1). The population (P) involved permanent and deciduous teeth with deep caries lesion. The intervention (I) was selective removal of dental caries followed by any type of restoration, whether temporary or definitive. The outcome, or (O) parameter was bacterial load related to dental caries after restoration (e.g.: S mutans, Lactobacillus). The bacterial load was the parameter chosen to indicate the success or failure of the restorative treatment.

P	Deciduous or permanent teeth with deep caries lesions
I	Selective caries removal technique + restoration
O	Bacterial load related to dental caries

Table 1 – Definition of PIO question and parameters.

Search strategy

A search was conducted by one researcher (MS) in five different databases: PubMed/MEDLINE, Scopus, ISI Web of Science, Lilacs (BBO) and Open Grey. The search terms and conceptual map were defined according to PubMed database for the parameters P, I and O defined in PIO question. After defining and testing the search terms, the search strategy defined for the Medline database (Appendix A) was adjusted to be used in the other four databases: Scopus, Web of Science, Lilacs (BBO) and Open Grey.

RESULTS

Search strategy

After search in all five databases, duplicates were removed using Mendeley software, and two different researchers (MS and CI) analysed the studies according to their title to select those which were according to the PIO question. Disagreements were solved by a third researcher (EB). Nineteen studies were included in the systematic review after first selection. After reading the abstracts from the selected studies, 7 studies were excluded and only 12 left to be used in the present systematic review (fig. 1).

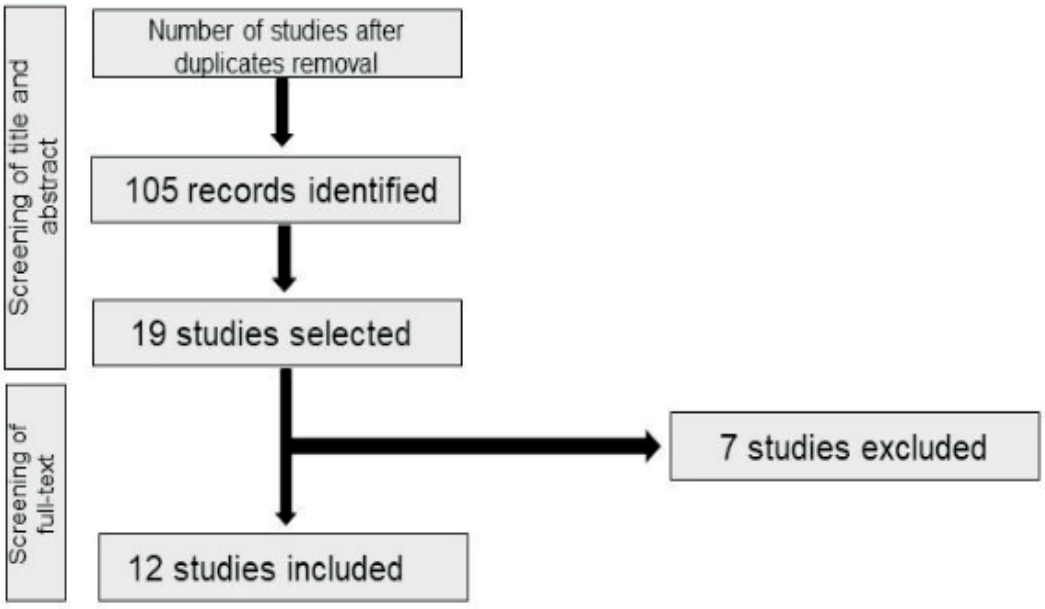

Figure 1: Search flow.

Bacterial load

All the studies included in the present systematic review evaluated bacterial load related to dental caries (table 2). The number of viable bacteria and Streptococcus spp. reduced considerably after selective caries removal and restorative temporary or permanent treatments. A reduced number of bacteria from Lactobacillus spp was observed only in 83% of the studies, approximately after selective caries removal technique, regardless the restorative material used.

Title	n	Bacterial load		*Restorative treatment*
		Initial bacterial load	Final bacterial load	
Clinical, mineral and ultrastructural changes in carious dentin of primary molars after restoration	45	High amount of different bacteria	Reduction in total viable bacteria	Glass ionomer cement
Partial caries removal in primary teeth: Association of clinical parameters with microbiological status	16	*Lactobacillus spp and S. mutans*	Reduction for Lactobacillus spp and S. mutans	Calcium hydroxide + Composite
Diversity of Lactobacillus species in deep carious lesions of primary molars	70	*L. paracasei spp, Paracasei L., Paracasei spp.*	Reduction in total viable bacteria, except for L. paracasei spp	Calcium hydroxide + temporary restoration
Clinical and microbiological performance of resin-modified glass-ionomer liners after incomplete dentine caries removal	9	*Lactobacillus spp and S. mutans*	Reduction for Lactobacillus spp and for S. mutans	Calcium hydroxide or GIC + zinc oxide-eugenol cement
Microbiological analysis after complete or partial removal of carious dentin in primary teeth: A randomized clinical trial	18	*Lactobacillus spp and S. mutans*	Reduction for Lactobacillus spp and S. mutans	Calcium hydroxide + Composite
A clinical and microbiological comparative study of deep carious lesion treatment in deciduous and young permanent molars	47	*Lactobacillus spp and S. mutans*	Reduction of Lactobacillus spp and S. mutans	Calcium hydroxide + temporary restoration
Ultrastructural and Microbiological Analysis of the Dentin Layers Affected by Caries Lesions in Primary Molars Treated by Minimal Intervention	30	*Total viable MO, Streptococcus spp, Streptococcus mutans, Lactobacillus spp and Actinomyces spp*	Reduction in bacteria	-
A clinical, microbiologic, and radiographic study of deep caries lesions after incomplete caries removal	30	*Aerobic and anaerobic MO, Lactobacillus spp and S. mutans*	Reduction for aerobic and anaerobic MO Lactobacillus spp and S. mutans	Calcium hydroxide + temporary restoration
Microbial Load After Selective and Complete Caries Removal in Permanent Molars: a Randomized Clinical Trial	16	*Total viable MO, Lactobacillus spp and S. mutans*	Reduction in total viable bacteria, S. mutans and Lactobacillus spp	Glass ionomer cement + composite
Conventional caries removal and sealed caries in permanent teeth: a microbiological evaluation	90	*Aerobic and anaerobic MO, Lactobacillus spp and S. mutans*	Reduction in aerobic and anaerobic MO, S. mutans, Lactobacillus spp	Calcium hydroxide + zinc oxide-eugenol cement
Mutans streptococci and lactobacilli in carious dentine before and after Atraumatic Restorative Treatment	40	*Viable bacteria, Lactobacillus spp and S. mutans*	Reduction of viable bacteria and S. mutans	Glass ionomer cement
A clinical and microbiological study of deep carious lesions during stepwise excavation using long treatment intervals	19	*Bacterial load*	Reduction of bacterial load	Calcium hydroxide + temporary restoration

Table 2 - Bacterial load before and after selective caries removal and restorative material used.

Clinical parameters

Table 3 shows the results of clinical parameters observed in the studies after

selective removal technique and restorative treatments. The clinical parameters, such as dentin color and consistency were demonstrated in 6 out of 12 studies included in this systematic review. Dentin darkening could be observed in 67% of the studies after caries removal and restorative treatment, whether temporary or permanent. Also, most subjects presented a change in the dentin consistency, which became harder in 83% of the studies.

Title	n	Color		Consistency	
		Initial color	Final color	Initial consistency	Final constistency
Clinical, mineral and ultrastructural changes in carious dentin of primary molars after restoration	45	Light brown	Light brown	Soft	Medium
Partial caries removal in primary teeth: Association of clinical parameters with microbiological status	16	Light brown	Dark brown	Medium	Hard
Clinical and microbiological performance of resin-modified glass-ionomer liners after incomplete dentine caries removal	9	Light brown	Dark brown	Medium	Hard
A clinical and microbiological comparative study of deep carious lesion treatment in deciduous and young permanent molars	47	Light brown and yellow	Light brown and yellow	Soft	Hard
A clinical, microbiologic, and radiographic study of deep caries lesions after incomplete caries removal	30	Light brown	Dark brown	Soft	Hard
A clinical and microbiological study of deep carious lesions during stepwise excavation using long treatment intervals	31	Light brown and yellow	Dark brown and black	Soft	Hard

Table 3 – Clinical parameters of color and consistency after selective caries removal.

DISCUSSION

Systematic reviews of literature are highly used to define clinical managements in dentistry because it is considered a type of study that fill in knowledge from different studies with high scientific evidence and is on the top of the evidence pyramid. The search approaches can be based on PICO question or PIO question format (Akobeng AK, 2004). The PIO question format used in the present study is a common model used to structure research questions in systematic reviews and is considered by the Cochrane handbook for Systematics Reviews a method that ensures that the relevant components of the question are well defined (Akobeng AK, 2004).

In the present study, PICO question was not used to guide the search terms, because the C parameter, or comparison, was not defined at the beginning of the study so that all studies related to selective caries removal could enter in the search and not only those that compared the selective caries removal with total caries removal technique, for example. Thus, in this literature review we could analyse different studies regarding the bacterial load and clinical parameters of selective caries removal in different stages and when compared with total caries removal.

We found that a reduction in bacterial load could be observed after selective caries removal technique and restorations, regardless the type of restoration, whether temporary or definitive. However, it could also be observed in some studies the presence of viable bacteria beneath restorations a few months after sealing (Maltz et al., 2012, Bönecker et al., 2003).

These findings can be explained by the fact that during dental caries process, the cariogenic microbiota is exposed in the oral environment to saliva components and to carbohydrates from the host diet which help bacteria growth. After cavity sealing, the remaining bacteria suffers from starvation and only few of them, which are able to adapt to that environment, can survive (Paddick et al., 2005). Bacteria adaptation consists in surviving in an environment with nutritional stress and with a different pH. In this scenario, only bacteria that can produce certain types of enzymes and are able to use as nutritional source the bacteria that did not survive environment change will survive (Paddick et al., 2005).

A meta-analysis could not be performed in the present study. This occurred because most part of the studies included in the present systematic review compared only the parameters under study (number of microorganisms, color and consistency) at baseline and after selective caries removal and did not compare with the conventional caries removal technique. Only 2 of the included studies compared these parameters between conventional caries removal and selective caries removal technique (Maltz et al., 2012, Bitello-Firmino et al., 2018). However the data provided did not fit the meta-analysis criteria and the authors from one study were not able to provide further required information (Bitello-Firmino et al., 2018).

The clinical parameters observed in the present literature review show that after selective caries removal color and consistency of affected dentin improved, suggesting the paralysation of dental caries process. In most part of studies, a color change from a yellowish appearance to dark brown appearance could be observed in the affected dentin after cavity sealing. Also, the consistency of the infected dentin improved from soft or medium hard to a hard tissue. These findings are related to the fact that infected dentin is able to remineralize after a period of time (Fusayama T, 1979), leading to these clinical parameters. The ability to remineralize is due to the presence of collagen and non-collagen proteins that are present in affected dentin (e.g.: DMP1 and DMP2). The collagen proteins are regulators for intrafibrillar remineralization through nucleation and mineral growth process. The non-collagen proteins are known to control biomineralization

in in vivo dentin (Cao et al., 2015). A harder dentin is clinically desirable as it is more resistant to mechanical forces and can delay bacterial accumulation and penetration, consequently, inhibiting caries progress (ten Cate JM, 2001). Regarding color, although the studies included in this review indicate that a darkening of the dentin is desirable and expected after selective caries removal and restoration, color alteration might not be a guidance for caries removal. This fact is supported by evidence in literature reporting lack of correlation between color of dentin and caries activity (Kidd EA, 2004, Schwendicke et al., 2016).

Regardless the success of the restorative treatments, although few studies have reported in literature a follow up of restorative treatments after selective caries removal technique (Singhal et al., 2016, Stafuzza et al., 2018), it is not well stablish if restorative treatments can remain successfully in oral environment due to the lack of studies evaluating this parameter. Mertz-fairhust et al., evaluated ultraconservative treatment of sealed restorations for 10 years. However, this study was not included in the present review because of the lost that occurred during the follow up period (Mertz-Fairhurst et al., 1998).

CONCLUSIONS

These findings suggest that:

- Selective caries removal technique is an efficient technique considering that the clinical parameters (dentin color and consistence) improved and the bacterial load was reduced in most part of the studies, suggesting that the dental caries process was paralysed;
- Regarding to the success of restorative treatment after the selective caries removal, studies with more years of follow up are missing in literature and more studies randomized clinical trials need to be conducted.

AUTHORS' CONTRIBUTION

This study was conducted during "Scientific Methodology" discipline, promoted by the Graduate Program in Operative Dentistry from the Institute of Science and Technology – UNESP. The role of each author was as follows: M.S.S, E.B, M.C.V and R.M design the study; M.S.S, E.B, C.M.I, G.S.L performed the study; M.S.S, E.B analysed the data; M.S.S, E.B wrote the paper; M.S.S, E.B revised the paper.

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ÍNDICE REMISSIVO

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