

# Overview of Treatment Strategies for Deep Carious Lesions

<sup>1</sup>Shaza Jameel Ashqar, <sup>2</sup>Abdullah Faisal Alim, <sup>3</sup>Hanan Abdullah Turkstani, <sup>4</sup>Danyah Abdulkarim Faisal Karsan, <sup>5</sup>Raji Ehsan Mohammed Kensara, <sup>6</sup>Nermeen Saad Felemban

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**Abstract:** Current study was aimed to demonstrate an overview of different treatment strategies for the dental management of deep carious lesions, through reviewing evidence based in this matter. We conducted a detailed search of several databases (MEDLINE, Evidence-Based Medicine Reviews, and EMBASE) using the following key words: “deep caries; deep carious lesions; partial caries removal; indirect pulp capping; pulpal exposure; stepwise excavation”. We limited the search to reports written in English describing studies using human subjects and published up to January 2016. Almost half of all dental professionals tested by the included studies favored invasive instead of evidence-based administration techniques for deep carious lesions in permanent teeth. Recently, this proportion appears to reduce. Dental professionals' behavior was affected by a range of factors, from their understanding of exactly what constitutes caries and how it must be managed in general, over contextual factors to systemic reinforcement mechanisms. Provided just quantitative researches being consisted of in this evaluation, future studies should entail some qualitative aspects to generate a further understanding of obstacles as well as facilitators towards less invasive carious tissue removal. Such understanding would likewise be required for tailoring application of interventions.

**Keywords:** Dental Management, Deep Carious Lesions, Evidence-Based Administration Techniques.

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## 1. INTRODUCTION

Dental caries is a widely common disease, burdening billions of individuals and also creating substantial healthcare costs <sup>(1)</sup>. The therapy of deep carious sores is especially testing for dental experts, because of this lesions are cavitated, with some dentin removal being required prior to placing a restoration to make certain the longevity of the remediation <sup>(2)</sup>, while such removal of dentin in closeness to the pulp is high-risk <sup>(3)</sup>. Increasing evidence supports selective (“insufficient”) or stepwise rather than non-selective dentin elimination in deep lesions of permanent teeth, as both avoid pulp exposure and also postoperative complications <sup>(4,5)</sup>. While non-selective removal makes use of the very same analysis criterion everywhere in the cavity (thus resulting in possibly damaging removal of dentin in distance to the pulp), discerning removal aims to leave tough dentin in the periphery and also tough or soft dentin in the pulpo-proximal areas of the dental caries <sup>(1)</sup>. Stepwise removal stands in-between, with the initial step amounting to discerning elimination, adhered to by a momentary sealing of the dental caries, adhered to by re-opening some months later on and also non-selective removal <sup>(1)</sup>. While both discerning and stepwise elimination are recommended for treating deep lesions in permanent teeth, careful elimination has some advantages over step-by-step removal (i.e., a lowered risk of pulp direct exposure, less variety of check outs needed, as well as lower expenses) <sup>(1,3)</sup>. A number of study studies, however, indicate that dental practitioners have actually not commonly taken on these less intrusive, evidence-based methods for taking care of deep lesions <sup>(6,7,8)</sup>. Organic approaches to handling rancid sores in deciduous molars welcome several techniques, one of the most significant being partial elimination of decayed tissue with or without resuming the tooth to supplement excavation, securing the carious sore, sealing the cavitated lesion with built steel crowns, known as the Hall method as well as, more lately, ultra-conservative treatment <sup>(9,10,11)</sup>. Despite expanding incentives to use these ultra-conservative

strategies, comparative research studies between methods are limited, which leaves medical professionals unsure as to their applicability within pediatric dental care <sup>(12)</sup>.

Current study was aimed to demonstrate an overview of different treatment strategies for the dental management of deep carious lesions, through reviewing evidence based in this matter.

## 2. METHODOLOGY

We conducted a detailed search of several databases (MEDLINE, Evidence-Based Medicine Reviews, and EMBASE) using the following key words: “deep caries; deep carious lesions; partial caries removal; indirect pulp capping; pulpal exposure; stepwise excavation”. We limited the search to reports written in English describing studies using human subjects and published up to January 2016.

## 3. RESULTS

### ➤ Overview of carious lesions in general:

The carious process starts in the enamel, with demineralization triggered by microbial acids that originate from dental biofilm. Normally, enamel sores can be arrested by means of control of dental biofilm, dietary adjustments as well as the sufficient use fluoride <sup>(13)</sup>. If the rancid sore is not regulated, the dental-enamel joint will be impacted as well as the lesion will advance towards the dentinal tubules, triggering progressive modifications in the dentin's solidity. As a result of these modifications, the dentin may be separated right into 2 layers, which are distinct from the morphological, biochemical, physiological and bacteriological perspectives <sup>(14)</sup>. The external layer of carious dentin is composed of a superficial necrotic cells, identified by the demineralization of the intertubular dentin, with scarce, granular crystals, few collagen fibers as well as an absence of odontoblast procedures and also intertubular dentin, whose room is loaded with bacteria or loosely dispersed crystals of numerous forms. This layer of softened cells, irreversibly denatured as well as without opportunity of remineralization, is called contaminated dentin. The underlying layer is partly demineralized as well as has apatite crystals together with collagen fibers that, unlike the superficial layer, display a striation that is characteristic of collagen. The intertubular dentin is demineralized, the odontoblast processes remain in area. It is, consequently, a cells that is harder than the infected dentin and also could be remineralized, being defined as impacted dentin <sup>(15)</sup>.

### ➤ Treatment of deep cavitated carious lesions:

Typical therapy of cavitated dentin lesions advocates total removal of the corroded structure, i.e. the afflicted as well as infected dentin layers. Throughout this procedure, however, a considerable quantity of the dental structure is eliminated as well as the pulp tissue might be exposed <sup>(4)</sup>. Because of this, the full removal of all corroded frameworks from a tooth with cavitated sores is no more seen as necessary, and there is expanding proof to support insufficient removal of corroded tissue before the remediation of the dental caries <sup>(25)</sup>. It is argued, however, that rancid lesions remaining in the dental caries must be entirely sealed in order to avoid their progression. Cavitated lesion therapy needs that less interest be provided to the complete excavation of corroded cells when contrasted to ample dental caries repair <sup>(26)</sup>. The clinical criteria that enable the recognition and also removal of contaminated tissue do not assure the total elimination of contaminated dentin, with microbes commonly unintentionally staying underneath the repair, even when the decayed cells is entirely eliminated. The visibility of these germs in the dentin is not in as well as of itself the factor that identifies the development of the rancid procedure. Therefore, a carious sore may be jailed through remediation and protecting against communication in between the lesion's microorganisms as well as the oral environment, along with stopping substratums from passing through <sup>(27)</sup>.

### ➤ Partial removal, excavation or expectant treatment approaches:

The strategy of partial removal of corroded tissue with reopening of the tooth cavity, gradual excavation or pregnant therapy promotes the elimination of decayed tissue in 2 phases <sup>(28)</sup> for teeth identified with reversible pulp inflammation as well as with a high risk of pulp exposure if subjected to total removal of corroded tissue. In the first session, full elimination of the softened tissue from the wall surfaces bordering the tooth cavity as well as of one of the most infected as well as softened dentin on the pulp wall surface should be performed, with part of the chaotic dentin staying at the end of the tooth cavity <sup>(29)</sup>. The dental caries may be full of calcium hydroxide-based material, although this is not necessary

<sup>(4)</sup>, as well as sealed with short-lived restorative product, remaining for a period of 2 to 9 months, and even 12 months, before being reopened for prospective supplementary removal of the decayed tissue that continued to be in the tooth cavity, complied with by conclusive remediation <sup>(30)</sup>. The purpose of the very first clinical session, therefore, is to modify the environment of the establishing lesion as well as isolate cariogenic microbes from the oral environment. In the 2nd session, after the removal of the short-term corrective material, analysis of the tooth's response to the treatment should be carried out by means of observation of the sore's medical look. Dry and also solidified cells suggests that the carious process has actually quit, as well as a reduced level of microbial colonization (30). After sealing the cavity, the number of microbes might reach degrees usually found in dental caries where all corroded cells has been eliminated, based on the standards of solidity as well as resistance to cells removal <sup>(31)</sup>.

Partial removal of decayed tissue in a single session consists of removing the contaminated dentin and also protecting the inmost layer of affected demineralized dentin, hence staying clear of the removal of oral tissue that could be remineralized, which decreases the extreme wear of dental cells <sup>(32)</sup>. Thus, this treatment minimizes the risk of pulp exposure and postoperative symptoms by protecting the dentin affected with the carious process, the elimination which would certainly damage pulp cells <sup>(4)</sup>. With the minimally invasive technique, the standards that restrict excavation of decayed cells are its structure and resistance to elimination, excavation being halted when the dentin begins to come away in chips <sup>(33)</sup>. Lula et alia, <sup>(34)</sup> reveal that the reduced the uniformity of the dentin protected after partial decays removal, the greater the number of *S. mutans*, however no relationship in between dentin uniformity and the *S. mutans* or *Lactobacillus* spp. count is observed after securing the cavity. The research study reveals that dentin that is plainly humid or damp harbors a bigger number of cariogenic bacteria compared to completely dry dentin. However, completely dry dentin, lack of *Lactobacillus* spp. and also reduced *S. mutans* counts were observed in all cavities assessed three to 6 months after being sealed, which indicates that the rancid process was detained which maintaining rancid dentin on the tooth cavity floor, in order to avoid pulp exposure, is sensible <sup>(34)</sup>.

#### ➤ Sealing techniques for treating carious lesions:

Resin-based sealants have actually been developed in order to produce physical barriers on the pits and crevices of occlusal surface areas prone to rancid sores, preventing the accumulation of food debris as well as biofilm in these locations and also, consequently, the development of carious sores <sup>(35)</sup>. However, there is growing evidence of their performance in controlling cavities currently established in posterior teeth and the recommendation for the application of occlusal sealants appears to be altering from primary prevention to therapeutic cavities administration in enamel and also the outside portion of the dentin <sup>(36)</sup>. Mertz-Fairhurst et al, <sup>(16)</sup> used a randomized split-mouth, four-celled design to compare closed composite restorations in teeth dealt with using partial caries removal with both secured and also unsealed amalgam restorations in teeth where all rancid cells had been removed. The research study population included 123 patients aged 8 to 52 years who contended least one set of honest Class I lesions that, according to the private investigators' radiographic evaluation, expanded as for halfway from the dentinoenamel joint (DEJ) to the pulp. An overall of 156 sets (312 teeth) were consisted of in the research study. The private investigators evaluated repairs radiographically along with medically (making use of an alteration of the Ryge/Snyder requirements) <sup>(17)</sup> at six months, one year and 2 years after therapy. They discovered no significant distinctions among the 3 treatments secured traditional, covered amalgam, unsealed amalgam at any type of duration. Mertz-Fairhurst's team followed up these patients across the next years <sup>(18,19)</sup>, finally observing that "the bound and secured composite remediations positioned over the honest cavitated lesions [had] detained the scientific progression of these lesions for 10 years." (19).

The randomized regulated trial performed by Ribeiro et al, <sup>(20)</sup> where they reviewed the performance of a dentin adhesive system, likewise served to examine the family member efficiency of partial and also full cavities elimination. After engraving, the private investigators used a bonding agent to both rancid and also noncarious dentin in 48 primary molars of 38 children aged 7 to 11 years. In one team, the clinicians removed rancid dentin completely from the DEJ however only superficially from the rest of the tooth cavity; they dealt with a 2nd group by entirely excavating caries. The investigators extracted 40 teeth (20 from each team) at regarding the moment of peeling (around one year after therapy) and also subjected the teeth to radiographic and also scanning electron microscopic evaluation. These outcomes, in addition to analyses of retention rates, minimal honesty and pulpal signs and symptoms, indicated no considerable differences between the two teams. An extra current research by Foley et al <sup>(21)</sup> contrasted the cariostatic performance of alternate corrective materials in both partial as well as total elimination of carious cells. The authors utilized a split-mouth

layout in 44 patients aged 3.7 to 9.5 years who had at the very least one set of previously unrestored primary molars that had no pulpal involvement. They treated one tooth of each pair by complete caries elimination and also the other by insufficient caries elimination complied with by repair utilizing copper phosphate concrete, glass ionomer cement (GIC) or both, or a material "of the driver's choice" (such as amalgam). At 24 months after therapy, teeth that had undergone partial cavities removal complied with by remediation with copper phosphate concrete as well as GIC exhibited higher abscess or sinus development than did teeth that had undertaken other therapies. Reconstructions placed in teeth treated with GIC alone after partial decays elimination, nevertheless, displayed a longevity and effectiveness similar with those placed in teeth that had undergone complete caries removal. In an observational research study, Maltz et al, <sup>(22)</sup> explored the effects of partial cavities removal in 32 teeth with deep carious sores. On the basis of clinical, microbiologic as well as radiographic proof at reentry six to 7 months after therapy (after which they placed a permanent restoration), the writers concluded that remineralization had happened which cavities had been jailed. In follow-up researches of the exact same patients, the authors reported similar results 14 to 18 months after treatment and 36 to 45 months after treatment <sup>(23,24)</sup>.

#### ➤ Ultra-conservative treatment of deep carious:

Ultra-conservative therapy is a strategy made use of for asymptomatic teeth, based upon controlling the main etiological factor of the growth and progression of rancid lesions. The technique promotes using Atraumatic Restorative Treatment (ART) for recovering tiny tooth cavities, as a tooth brush's bristles are unable to permeate narrow tooth cavities and sufficiently eliminate biofilm <sup>(37)</sup>. In regards to survival, atraumatic restorations made with glass ionomer seals perform similarly to traditional restorative therapies using amalgam <sup>(38)</sup> and composite materials <sup>(39)</sup>. ART, however, is better accepted by small children as well as, as it can be used in places where there is no electricity or running water, its use can boost the prevention and also restoration of rancid lesions <sup>(40)</sup>.

For medium-to-large cavities, ultra-conservative treatment supports the removal of biofilm with a brush and fluoride toothpaste <sup>(41,42)</sup>. In many cases, the tooth cavity is broadened in order to help with the elimination of biofilm <sup>(42)</sup>. The success of the method involves the reliable control of biofilm, which should be eliminated or at the very least disordered daily in order to apprehend the carious lesion <sup>(42)</sup>. This therapy might be comprehended as a program to control caries disease, in which periodic check outs to the dental expert should be considered essential to keeping track of caries lesion task <sup>(41)</sup>. Casagrande et al, <sup>(43)</sup> examined the clinical performance of glue restorations utilizing composite resins as well as resin-modified glass ionomer cements in occlusal as well as occlusal-proximal cavities of deciduous molars subjected to complete or partial removal of corroded tissue. The authors located that the kind of restorative material utilized did not affect remediation long life over the 18-month follow-up period. The most prevalent failing was the loss of the reconstruction's limited honesty, which happened in all the products evaluated, no matter incomplete or complete caries removal, and with repairs entailing one or more surfaces. As relates to which corrective material is best in each scenario, it is understood that composite material restorations tend to reveal higher failing prices when a patient remains with energetic carious sores. This is most likely because of the fact that the patient offers with the etiological factors of the caries disease, such as a high price of noticeable biofilm, uncontrolled diet regimen and also restricted access to fluoride <sup>(44)</sup>. Nonetheless, there is proof that composite resin remediations in deciduous molars have a medical follow-up time suitable with the exfoliation duration, which suffices for them to be recommended as a therapeutic corrective choice for dealing with carious lesions in milk teeth. This is justified by the truth that patients with energetic rancid sores are kept under therapy as well as should return for disease control or precautionary maintenance. As a result, restorative failures can be identified as well as fixed in time, as studies on irreversible teeth reveal that the survival of glue remediations is similar whether or not they undergo repair work <sup>(45)</sup>.

## 4. CONCLUSION

Almost half of all dental professionals tested by the included studies favored invasive instead of evidence-based administration techniques for deep carious lesions in permanent teeth. Recently, this proportion appears to reduce. Dental professionals' behavior was affected by a range of factors, from their understanding of exactly what constitutes caries and how it must be managed in general, over contextual factors to systemic reinforcement mechanisms. Provided just quantitative researches being consisted of in this evaluation, future studies should entail some qualitative aspects to generate a further understanding of obstacles as well as facilitators towards less invasive carious tissue removal. Such understanding would likewise be required for tailoring application of interventions.

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