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Dentist's Decision in Excavation of Deep Dentinal Carious Lesion in Primary Molars: A Questionnaire-Based Survey

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Abstract

Introduction: With the improvement in knowledge about dental caries, various approaches such as total excavation (TE), step-wise excavation (SWE), and selective caries removal (SCR) have been developed over the years for the management of deep dentinal caries (DDC). The present study aimed to evaluate the knowledge, attitude, and practice of dental students and professionals related to the management of DDC in primary molars with special emphasis on pedodontists.

Material and Methods: A questionnaire comprising 14 questions divided into the domains- type of excavation, choice of the liner, and choice of restoration was propagated to 200 dental professionals by means of online platform. The data were recorded in an Excel datasheet and subjected to statistical analysis.

Results: The study population comprised 30 (21%) general dental practitioners, 70 (49%) pediatric dentists, and 43 (30%) practitioners from dental specialties other than pediatric dentistry. A statistically significant ($p < 0.05$) difference was found with a higher number of pedodontists preferring SCR, use of spoon excavators, criteria for limiting caries excavation, use of MTA as a liner, and Biodentin as a restorative material.

Conclusion: Findings from the present study indicate that pedodontists prefer more conservative options that minimize the risk of pulp exposure for the treatment of DDC. In contrast, general practitioners and those from other specialties aim for attaining a radical cure with a view to achieving long-term success.

Keywords

Pediatric dentistry; Selective excavation; Step-wise excavation; Pulp exposure

Introduction

Dental caries is the most prevalent chronic disease of the oral cavity that is characterized by the destruction of tooth structure by acids and other enzymes produced by pathogenic bacteria. The essence of dentistry lies in the elimination of the pathology and restoration of the harmonious integrity between the various structures of the oral cavity. In the case of dental caries, total excavation (TE) of the pathogenic microbiota along with the parts of teeth affected by the former has been practiced as the gold standard since historical times [1]. With recent developments in the knowledge about the pathogenesis of caries, considerable evidence has been gathered in support of the fact that the removal of caries partially suffices to halt the progression of the disease and enable its restoration. Consequently, more conservative approaches for the management of DDC such as step-wise excavation (SWE) and selective caries removal (SCR) have come into the picture [2,3].

The rationale behind these concepts is that the remnant bacterial colonies cannot sustain themselves when the supply of nutrients is cut off from the oral cavity by means of restoration.[4] The use of the SCR technique minimizes the risk of damaging the pulp while also reducing the cost and chairside time required for the treatment [2,4]. This is of particular importance in the field of pediatric dentistry wherein the pedodontist has to expend additional behavior management techniques to ensure the child's cooperation during the intervention procedures. A recent systematic review demonstrated that the efficacy of SCR might be comparable to that of non-selective caries removal in children and adolescents with a decreased risk for pulp exposure [5]. Very few studies have explored the preference of dental professionals for the choice of technique in the management of deep dentinal caries. In this context, the present study aimed to evaluate the knowledge, attitude, and practice of dental students and professionals related to the management of deep dentinal carious lesions in primary molars with special

emphasis on pedodontists. Yet another objective of the study was to compare the preference of pediatric dentists with those of general practitioners and practitioners from other dental specialties.

Methods

The present cross-sectional study was conducted on 200 dental professionals and students by means of a pre-validated questionnaire. The study population comprised graduate and postgraduate dental students, dental professionals affiliated with institutes, and clinicians in private practice. The questionnaire comprised 14 questions based on the knowledge, attitude, and practice of dental professionals concerning the management of deep dentinal caries. The questions were briefly divided into the domains- type of excavation, choice of liner, and choice of restoration.

The questionnaire was designed through Google Forms and propagated by means of online platforms including e-mail and direct messengers. A total of 43 individuals responded to the questionnaire, thus, making the response rate for the present survey as 71%. The responses were recorded in a digital worksheet (Microsoft Excel v2019, Redmond, USA) and subjected to further statistical analysis using Statistical Package for the Social Sciences (SPSS) software v16. Descriptive statistics of the demographic features of the respondents and their responses to the questionnaire were calculated.

Results

The study population comprised 30 (21%) general dental practitioners, 70 (49%) pediatric dentists, and 43 (30%) practitioners from dental specialties other than pediatric dentistry. About 65 (45%) of the participants solely practiced clinical dentistry, 34 (24%) worked as academicians, and 44 (31%) practiced along with institutional academic affiliation. The choice of approach for caries removal as denoted by the participants is tabularized in Figure 1. A statistically significant ($p=0.01$) difference was found with a higher number of pedodontists preferring SCR as compared to others, while the later had a significantly high preference for SWE and TE.

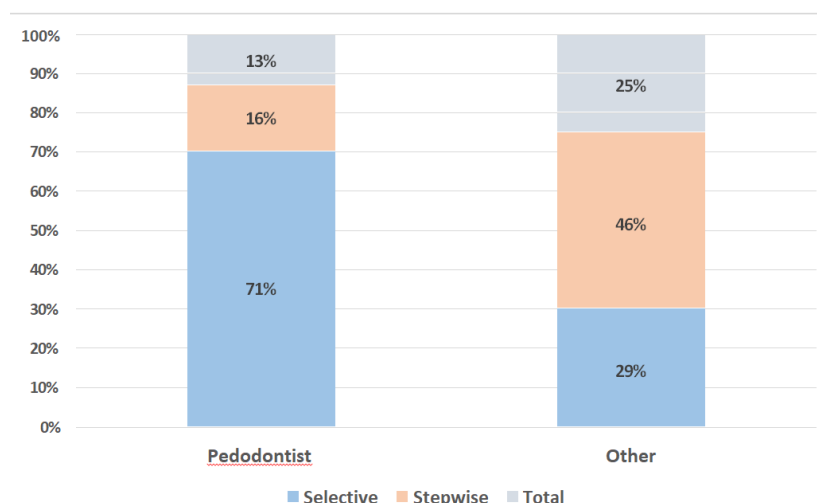


Figure 1: Participant's choice of approach for caries removal.

The majority of the general practitioners and those from other specialties 60 (82%) agreed that the cariogenic micro-organisms should be removed completely since caries might progress otherwise, while only 35 (51%) of the pedodontists agreed to the same. The difference was statistically significant ($p=0.01$) when considering the number of participants for the respective responses. Nevertheless, about an equal number of pedodontists 52(76%) and other participants 53(75%) agreed that a certain amount of micro-organisms can be left while excavating caries since the intact restoration can seal and arrest caries.

The criteria discerned by the participants to limit the excavation of caries is depicted in Figure 2. The number of pedodontists was significantly higher ($p=0.01$) when considering the hardness of dentin as a criterion for limiting the excavation as compared to general dentists, while a significantly higher number of the latter considered color of the dentin alone or along with hardness as the criteria.

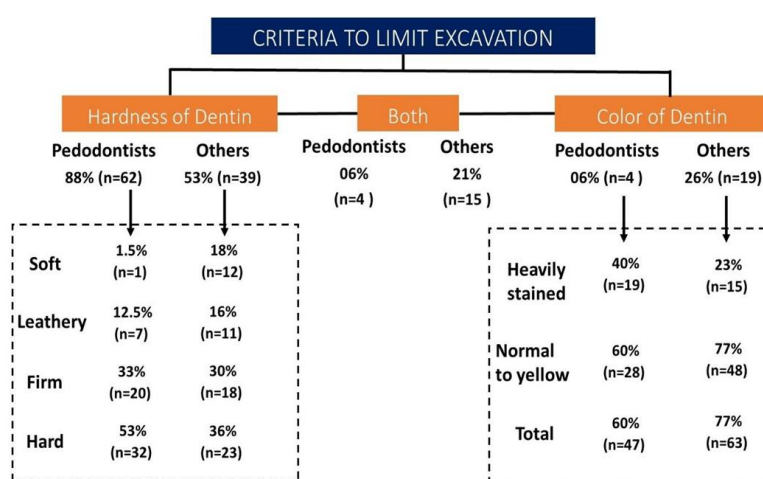


Figure 2: Criteria to limit the excavation of deep dentinal caries as gauged by the respondents.

However, in cases of deep dentinal caries close to the pulp 41 (58%) of pedodontists and 31 (42%) of others agreed that caries in the proximity of the pulp should not be excavated to avoid inadvertent pulp exposure, and the difference in the number of respondents was statistically non-significant ($p=0.15$). In case of pulp exposure, the choice of procedure ranged from direct pulp capping (DPC) to extraction of the involved tooth. The overall distribution of choice of procedure by the respective number of participants for each is depicted in Figure 3. A significantly higher number of general dentists and other specialists preferred DPC while a higher number of pedodontists preferred pulpotomy procedures.

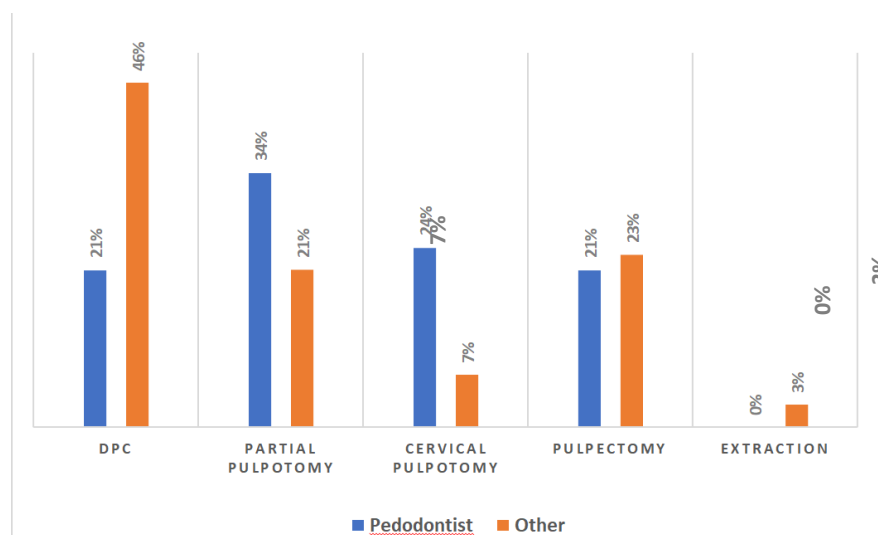


Figure 3: Choice of procedure in case of pulp exposure.

The choice of material of the respondents during various treatment steps is summarized in Table 1. The number of pedodontists preferring spoon excavators for removing deep dental caries was significantly higher as compared to general practitioners and those from other specialties, who preferred carbide burs ($p=0.01$). Metal bur with slow speed was preferred more by practitioners other than pedodontists. Very few pedodontist and other practitioners preferred chemomechanical caries removal 3(5%) and 5(7%) respectively. A statistically significant difference ($p=0.02$) was noted with a higher number of general dentists preferring calcium hydroxide as a liner and glass ionomer cement (GIC) as the restorative material. On the other hand, a significantly higher ($p=0.02$) number of pedodontists preferred MTA and Biodentin as liners and resin-modified GIC and composite as restorative materials.

Purpose	Choice of material	Pedodontist	Other	p-value
Excavation of caries	Spoon excavator	52(74%)	27(37%)	0.01
	Metal bur with slow speed	6(9%)	18(24%)	
	Chemomechanical caries removal	3(5%)	5(7%)	
	carbide burs or diamond points	9(12%)	23(32%)	
Liner	Calcium hydroxide	4 (6%)	24 (33%)	0.02

	Dycal	27 (38%)	24 (33%)
	MTA	16 (22%)	9 (12%)
	Biodentine	20 (29%)	12 (16%)
	None	2 (3.5%)	2 (3%)

	Any other	1 (1.5%)	2 (3%)	
Restorative material	GIC	28 (40%)	46 (63%)	0.02
	RMGIC	34 (48%)	23 (31%)	
	Composite resin	8 (12%)	4 (6%)	

Table 1: Choice of material of the respondents during various steps of intervention procedures.

Discussion

It has been demonstrated that the bacteria packed in the dentinal tubules in the advancing front of a carious lesion become isolated from their source of nutrition when restoration of adequate integrity is placed [4]. Consequently, they are not able to sustain their colonies and the organisms become dormant or die, either way removing the hazard posed to the health of the tooth [4]. Coupled with the reduced risk of pulp exposure that would avoid additional unnecessary procedures in the future, the SCR approach would seem more rational for treating DDC in the primary teeth [2,4]. The reduced chair-side time and need for anesthesia further make SCR preferable to pediatric dentists, which would account for the significantly higher number of pedodontists for choosing SCR [5,6]. The SWE approach requires multiple appointments and sufficient time for the tooth to form reparative dentin [7]. The technique also minimizes the chances of pulp exposure. Likewise, the SWE approach was also preferred by a significantly higher number of practitioners other than pediatric dentists in the present study.

No significant difference has been reported in the outcomes of teeth in children and adolescents treated with SCR and TE approaches respectively, thereby vouching for the efficacy of the former in the treatment of DDC [5]. In the present study, the concept that cariogenic microbes must be eliminated completely to halt the progress of caries was agreed upon by most of the general practitioners while only half of the pedodontists believed so. Thus, most of the practitioners other than pediatric dentists advocated for the TE approach for the treatment of DDC for achieving long-term success. The preference of general practitioners and those from other specialties for excavation with burs could be explained by their preference in favor of TE as compared to pediatric dentists that preferred spoon excavators suitable for their SCR approach [6].

There yet exists ambiguity regarding the extent of excavation of enamel and dentin in the portions of teeth affected by DDC [8]. While removal of some part of dentin, leaving some part of the affected dentin on the floor of the carious lesion is widely accepted. In the present study, pedodontists discerned the hardness of dentin as a criterion sufficient for limiting the excavation, while general dentists also considered the color of the dentin along with hardness. A significantly higher number of pediatric dentists

believed that caries in the proximity of the pulp should not be excavated to avoid inadvertent pulp exposure. This could be attributable to the knowledge of pedodontists pertaining to the SCR approach.[4] Furthermore, the success rate of pulpectomy procedures has been demonstrated to be seven times lower as compared to the other conservative approaches such as direct pulp capping and pulpotomy [13,14]. On the other hand, other practitioners preferred a more radical approach in favor of attaining long-term success for the treatment.

The number of pedodontists preferring spoon excavators for removing deep dentinal caries was significantly higher as compared to general practitioners and those from other specialties who preferred carbide burs. Very few of pedodontist as well as other practitioners preferred chemomechanical caries removal 3(5%) and 5(7%) respectively.. While chemomechanical caries removal eliminates the need for invasive aerosol-generating procedures and also reduces the risk of pulp exposure, it has been consistently found that their caries removal ability is slower as compared to rotary instruments, and large amounts of solution are required before a satisfactory clinical outcome can be achieved. The higher cost, shorter shelf life, need for refrigeration, unpleasant taste and odor, and requirement of specialized cures.

In the present study, there is significantly higher number of pediatric dentist preferring pulpotomy procedures whereas other practitioners exhibited an inclination towards DPC. There is no significant difference exists in the survival of carious primary molars treated with DPC or pulpotomy [15]. Materials such as MTA and Biodentin have demonstrated highly successful clinical outcomes in primary teeth as compared to conventional calcium hydroxide and GIC as liner and restorative materials respectively [16,17]. MTA's popularity can be attributed to several factors including its high biocompatibility, ability to induce hard tissues even in little quantities, and good sealing properties. MTA has been demonstrated to possess superior clinical properties than calcium hydroxide, wherein the former material has a higher success rate, less inflammatory response, and more predictable formation of dentin bridge with shorter induction times than the latter. The superior clinical performance of MTA cements when compared with CaOH cements was observed, with statistically significant differences, in the three outcomes analysed, that is, the success rate, the inflammatory response and the dentin bridge.

Other reviews also conclude that MTA cements have higher success rates, results with less intense inflammatory responses, and more predictable formation of dentin bridges than calcium hydroxide cements. Other authors report that MTA cements are associated with significant induction shorter times of apical barrier formation in immature teeth. Biodentin, on the other hand, is relatively easier to manipulate, faster setting time, higher compressive and flexural strength, and improved bioactivity as compared to MTA. The material's large porosity and water sorption are correlated with a pronounced ion release allowing the formation of calcium phosphate deposits. Consequently, it has found wide applications in pediatric dentistry for crown and root dentin repair, repair of perforations or resorptions, apexification, root-end fillings and as permanent dentine substitute in large carious lesions. The creation of physiologic hard tissue barrier is the primary advantage of using calcium hydroxide as a pulp capping agent along with antimicrobial properties. The material is highly feasible, has a low cost, and easily available. However, the disadvantages of using the material include requirement of multiple

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appointments, longer duration for formation of dentin bridge, reduction in dentinal microhardness, microleakage, and lesser biocompatibility as compared to other materials that are currently used in the clinics. Ironically, the use of calcium hydroxide in deciduous teeth has been discouraged owing to its propensity to cause chronic pulpal inflammation and internal root resorption. A recent meta-analysis has found that direct pulp capping with calcium hydroxide has a pooled success rate of 59%, MTA has 84% and Biodentine has 86% after 2-3 years of procedure.

This would explain the former being the choice of materials for the respective purposes in the treatment of DDCs in children. Our study has certain inherent limitations wherein influence of the work experience on the responses was not analyzed which could have possibly confounded the results. A detailed comparison between pedodontists and practitioners from each respective dental specialty could also be carried out in the future to better understand the differences in their practices. Nevertheless, the present study clearly indicates the preference of pedodontists and other practitioners regarding various aspects of the treatment of DDC.

Conclusion

Findings from the present study indicate that pedodontists prefer more conservative options that minimize the risk of pulp exposure for the treatment of DDC. In contrast, general practitioners and those from other specialties aim for attaining a radical cure with a view to achieving long-term success.

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