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Original Article

Management preferences of deep caries in permanent teeth among dentists in Saudi Arabia

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ABSTRACT

Objective: To report the management preferences of deep caries in permanent teeth among dentists. **Materials and Methods:** This observational cross-sectional study included a convenience sample of 177 dentists selected from private and public dental clinics in different cities of the Eastern Province of Saudi Arabia. Four clinical scenarios about the absence or presence of pain/symptoms and the risk of pulp exposure in deep caries were presented to the dentists in a pilot-tested questionnaire. **Results:** Most dentists (82.5%) preferred complete caries excavation when there was no risk of pulp exposure and no pain/symptom was associated with deep caries in permanent teeth. The stepwise technique was the procedure of choice reported by 57.8% of dentists when there was no pain but a risk of exposure was present. In case of no exposure risk but the presence of nonspontaneous pain (pain on thermal testing), complete caries removal was chosen by 55.9% of the respondents. Root canal treatment and stepwise caries removal were preferred by 42.4% and 38.4%, respectively, when there was a risk of exposure and nonspontaneous pain. The risk of exposure (81.4%), the progression of caries (73.4%), and treatment failure (58.8%) were the most common concerns with different caries removal techniques. The hardness was the most commonly used criterion (85.3%) followed by the color of caries (50.3%) during caries excavation. **Conclusions:** The majority of dentists preferred to completely remove caries in case of no risk of pulp exposure. The dentists should update their knowledge and adopt latest concepts about minimally invasive caries removal approaches.

Key words: Deep caries, partial caries removal, stepwise caries removal, total caries removal

INTRODUCTION

Dental practitioners often come across deep carious lesions which if eliminated totally may lead to pulp exposure.[1] In such situations, the majority of practitioners may choose to perform pulpectomy as the treatment of choice despite the fact that the pulp can regenerate and the inflammation can be reversed.[2] Even today, the management of deep caries approximating the pulp is a challenge for clinicians.[3] Traditionally, the treatment entails a total elimination of carious lesion to stop the progression of the disease and to provide a stable platform for

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the restoration thereafter. However, this trend has been questioned because both the tooth structure and the pulp could be affected adversely.[4,5] Other more conservative techniques of caries management have been recommended in the literature.[6,7] Removal of deep caries over two visits separated by a period of weeks to months is a stepwise excavation technique.[6] Incomplete removal of carious dentin and leaving residual caries under the permanent restoration is known as partial caries removal technique.[7]

The stepwise technique is an efficient way to save and protect the pulp, especially in cases where caries is very deep.[8] Bjørndal *et al*. reported that stepwise technique was 12% more successful than the complete elimination of caries after 1-year of follow-up.[9] On the other hand, the concerns for post-treatment symptoms including pulp exposure could be allayed by partial removal of caries. The literature shows that incomplete excavation does not predispose teeth with deep caries to more post-operative complications.[10] In comparing stepwise technique with partial caries removal, the success rates were 99% and 86%, respectively, when cases were followed up to 1.5 years.[11]

The approach toward deep caries management is influenced by the age of dentist, knowledge about the pathology of caries, and the understanding of the scientific basis of different techniques.[12] Dentists do not agree on single uniform management because the available evidence about the effectiveness of different treatments of deep carious lesions is inconsistent.[13] The management preferences for caries removal vary in different parts of the world.[1,14-18] However, data are limited about deep caries management preferences among dentists from the Middle East. Furthermore, little is known about the influence of gender and clinical experience of dentists in managing deep carious lesions. This study aimed to report the management preference of deep caries and evaluate gender and years of experience differences among dentists in the Eastern province of Saudi Arabia.

MATERIALS AND METHODS

This observational cross-sectional study was conducted in the form of printed self-administered questionnaire following ethical approval. The dentists from the public and private dental clinics in the cities of Dammam, Khobar, Dhahran, Qatif, Al Ahsa, and Abqaiq were approached in person to achieve a higher response rate. The dentists (n = 243) willing to participate in the study were provided with a questionnaire. The respondents were briefed about the purpose and potential benefits of the study and their rights as participants. In addition, they were provided with the contact of researchers for any queries. Implied consent was obtained by filling out the questionnaires.

A questionnaire was developed based on the information from the previous studies.[1,14-16] The instrument was piloted by distributing it over a group of 25 dentists, and based on their responses, minor corrections were made to increase the success of the study.[19] The final questionnaire consisted of 17 questions distributed over three sections. The first section collected participants' demographic data including age, gender, level of qualification, and place of work.

The second section consisted of four different clinical scenarios about the absence or presence of pain/symptoms and the risk of pulp exposure similar to a previous research.[15] The respondents were asked about their opinion to manage deep caries in each situation. In the first clinical scenario, there was no pain or risk of pulp exposure associated with deep caries. The second clinical situation presented no pain, but a risk of exposure was present. The third clinical scenario showed nonspontaneous pain to cold or hot stimulus but no risk of exposure. The last scenario was about a nonspontaneous provoke pain with a risk of exposure.

The fourth section included questions about the behavior of dentists toward incomplete caries removal, diagnostic criteria, and expected success rate of different management techniques, namely complete caries excavation, stepwise caries excavation, and partial caries removal.

Statistical analyses were performed using SPSS Version 22.0 (IBM Corp. Armonk, NY, USA). Frequency distribution was calculated for qualitative variables, and means and standard deviations were determined for quantitative variables. Chi-square test was used to compare study responses between gender and years of clinical experience at a significance level of $P < 0.05$.

RESULTS

Of 243 dentists, 177 returned the questionnaire giving a satisfactory response rate of 72.8%. Respondents included 63.3% (n = 112) male and 36.7% (n = 65) female

dentists. The majority, i.e., 73.4% (n = 130) worked in the government sector [Table 1]. The participants had an average experience of 9.25 ± 8.43 years in dental practice. Complete caries excavation was the management of choice by 82.5% (n = 146) when there was no pain and no risk of pulp exposure associated with deep caries in permanent teeth. The stepwise technique was preferred by 57.8% (n = 102) if there was no pain but a risk of exposure was present. Complete caries removal was chosen by 55.9% of respondents, in case of nonspontaneous pain associated with no risk of exposure. The respondents were split between root canal treatment (42.4%) and stepwise technique (38.4%) if there were nonspontaneous pain and a risk of exposure [Table 2].

About half (47.5%) of the respondents agreed that it was unethical to leave residual caries under the permanent restorations in deep cavities. However, all respondents disagreed that complete caries removal was necessary even if the pulp exposure was expected in deep caries. The pulp exposure (81.4%) was the major concern associated with complete caries removal technique. Regarding partial caries removal technique, the progression of caries (73.4%) and treatment failure (58.8%) were the most common concerns. Approximately 55% of the respondents considered that stepwise caries excavation technique could increase the risk of postoperative pain [Table 3]. About 81.4% of the dentists believed that high success rate (>80%) was associated with complete caries removal [Table 4].

The criteria used to assess caries removal in deep lesions are summarized in Figure 1. Hardness (85.3%) was the most commonly used criterion followed by the color of carious dentin (50.3%). No statistically significant differences were found between male and female respondents regarding the management of deep caries, major concerns associated with different techniques, and the success rates (P > 0.05). Similarly, the opinion of the dentists with ≥ 10 years of clinical experience did not significantly differ from the participants with <10 years of experience (P > 0.05).

DISCUSSION

This study attempted to report the management preferences of deep caries and evaluate gender and years of experience differences among dentists in the Eastern province of Saudi Arabia. The most preferred management for deep asymptomatic caries with no expected exposure was complete caries excavation by the majority of dentists (82.5%), and only 9% preferred stepwise caries removal in the present study. The results are in agreement with a previous study. Weber *et al*. reported that in Sothern Brazil, most dentists (71.1%) were in favor of complete caries removal and 17.6% preferred stepwise excavation.[14]

Table 1: Demographic information of study participants

Demographic characteristics	*n* (%)
Gender	
Male	112 (63.3)
Female	65 (36.7)
Place of work	
Private clinics	42 (23.7)
Government clinics	130 (73.4)
Both private and public clinics	5 (2.8)
Years in clinical practice	
1-5 years	86 (48.5)
6-10 years	25 (14.1)
11-20 years	48 (27.1)
21-30 years	18 (10.2)

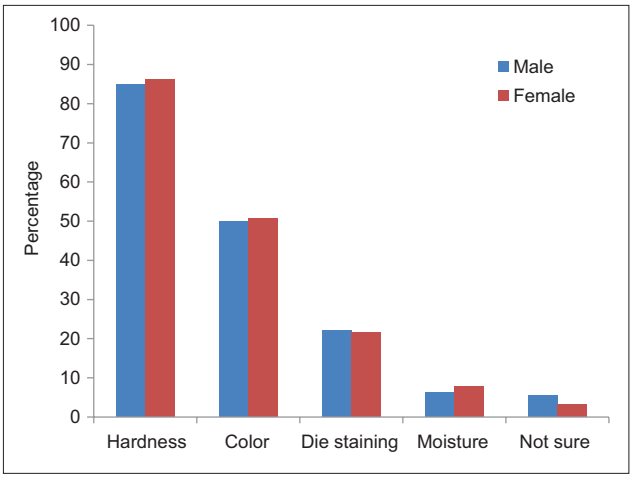

Figure 1: Criteria to assess caries removal in deep caries

Table 2: Management preferences of deep caries in different clinical situations

Clinical scenarios	Complete caries removal, *n* (%)	Partial caries removal, *n* (%)	Root canal treatment, *n* (%)	Stepwise caries removal, *n* (%)
1. No risk of exposure, no symptoms	146 (82.5)	14 (7.9)	1 (0.6)	16 (9)
2. Risk of exposure, no pain	32 (18.1)	32 (18.1)	11 (6.2)	102 (57.8)
3. No risk of exposure, nonspontaneous pain	99 (55.9)	10 (5.6)	22 (12.4)	46 (26)
4. Risk of exposure, nonspontaneous pain	22 (12.4)	12 (6.8)	75 (42.4)	68 (38.4)

Table 3: Major concerns for dentists about different techniques of caries removal

Techniques of caries removal	*n* (%)
Complete caries removal	
Risk of exposure	144 (81.4)
Risk of postoperative pain	88 (49.7)
Risk of treatment failure	27 (15.3)
Risk of progression of caries	33 (18.6)
Longevity of the restoration	33 (18.6)
Partial caries removal	
Risk of exposure	49 (27.7)
Risk of postoperative pain	83 (46.9)
Risk of treatment failure	104 (58.8)
Risk of progression of caries	130 (73.4)
Longevity of the restoration	34 (19.2)
Stepwise caries excavation	
Risk of exposure	54 (30.5)
Risk of postoperative pain	98 (55.4)
Risk of treatment failure	81 (45.8)
Risk of progression of caries	70 (39.5)
Longevity of the restoration	36 (20.3)

Table 4: Dentists' opinion about the success rate of different techniques of caries removal

Techniques of caries removal	*n* (%)
Complete caries removal	
>80%	144 (81.4)
51%-80%	31 (17.5)
20%-50%	1 (0.6)
<20%	1 (0.6)
Partial caries removal	
>80%	11 (6.2)
51%-80%	35 (19.8)
20%-50%	73 (41.2)
<20%	58 (32.8)
Stepwise caries excavation	
>80%	38 (21.5)
51%-80%	95 (53.7)
20%-50%	40 (22.6)
<20%	4 (2.3)

In contrast, a Norwegian study reported that dentists showed an almost equal preference for complete caries removal (49%) and stepwise caries excavation (45%) techniques in a similar clinical situation.[15] In the present study, dentists' preference for complete caries removal technique could be either due to the limited knowledge about the effectiveness of stepwise caries excavation[20] or they were unaware of current concepts of minimally invasive dentistry.[21] Recently, a study showed that most dentists in Saudi Arabia had no knowledge or training of minimally invasive procedures.[22]

Previous studies showed differences in the preferences of dentists for various techniques. In a survey among German dentists, 50% said that they would remove caries completely even if pulp exposure was expected.[1] Similarly, Oen *et al*. reported that 62% of US dentists preferred total caries removal even when there was a risk of exposure.[16] Another survey reported that German and French dentists preferred complete caries removal while Norwegian dental professionals frequently used a stepwise technique.[18] In the present study, the risk of exposure dramatically influenced dentists' decision as only 8.1%–12.4% opted for complete caries removal when there was a risk of pulp exposure with or without pain. It can be seen that management preferences differ widely in different parts of the world, but the risk of pulp exposure appears the most important variable when dealing with deep carious lesions among dentists in the Eastern province of Saudi Arabia.

It has been reported that stepwise technique has a significantly better success rate (74%) than complete caries excavation (62.4%) after 1 year of follow-up.[9] However, patient compliance, an increased cost, and failure of temporary restoration are drawbacks of this technique.[11] Maltz *et al*. found that the partial caries removal success rate (99%) was higher than stepwise technique (86%) after 18 months of follow-up in their multicenter randomized controlled trial.[11] Nevertheless, partial caries removal was practiced by a small percentage of dentists in our study which is similar to the results reported by Weber *et al*.[14] What mostly concerned the participants (73.4%) was the progression of caries followed by treatment failure and postoperative pain with partial caries excavation technique. Moreover, almost half (48%) went further to consider this approach unethical, and two-thirds expected <50% success rate. There is no evidence that leaving residual caries renders tooth prone to complications; in fact, incomplete caries removal can be advantageous.[10]

Lack of valid and reliable diagnostic criteria presents a challenge for clinicians to decide the extent to which caries should be removed.[1] The hardness of dentin is a general criterion applied to determine the extent of caries.[17,18] Most of the dentists in our study also used hardness of affected dentin to assess the caries excavation. The findings are in agreement with the previous studies.[1,17,18] A recent survey reported that dentists in the US used the hardness as the primary criterion for caries removal.[17] Similarly, most German, French, and Norwegian dentists used hardness as a criterion for caries removal.[1,18]

Years of clinical experience had been associated with the different excavation techniques, and dental professionals with less than 10 years of experience preferred more conservative approaches than those with more than 10 years of experience.[14] On the contrary, our study did not find an association between years of clinical experience and gender with the type of caries removal procedure, and the findings are in agreement with the results of a previous study.[1]

The questionnaires were distributed among dentists in the major cities of the Eastern province, and practitioners working in remote areas were not included in the study. The majority of the respondents were male dentists working in public dental clinics. Future studies should involve different regions of the country to evaluate trends in deep caries management at national level and investigate differences in management preferences by gender (male and female dentists) and type of dental office (private and public).

CONCLUSIONS

The results showed that the majority of dentists preferred complete caries removal when there was no risk of pulp exposure, and stepwise caries excavation was opted in case risk of exposure was present. Partial caries removal was the least preferred technique due to the fear of caries progression.

Dental practitioners need to update themselves and practice minimally invasive approaches for caries management. Dentistry curriculum and continuing education programs should focus on teaching conservative techniques to dental students and practitioners.

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Conflicts of interest
There are no conflicts of interest.

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