

Development and validation of an Arabic questionnaire to assess dentist knowledge on managing deep caries cavities.

Rashad Mhd Khair Alghorani¹, Hussam Mahmoud Malli²

¹ DDS, MSc. Master's degree student, Department of endodontics. Damascus university, Syria.

² DDS, MSc, PhD. Assistant professor. Department of endodontics. Damascus university, Syria.

Abstract:

Introduction: The interconnection between oral health and systemic well-being is widely recognized, with dental caries being a prevalent global oral disease. Understanding the diagnosis and having the ability to deliver the appropriate treatment is crucial for dental professionals to effectively manage this common condition and its complications.

Aim: To create and validate the first Arabic questionnaire specifically for assessing dentists' competence in diagnosing and managing deep caries cavities.

Methods: The study adopted a multi-stage approach, including translation and adaptation of existing questionnaires, addition of new items by experts, and a thorough validation process. The research sample size consisted of 20 dentists from Damascus University Faculty of Dentistry who participated in filling the questionnaire (test and retest). The questionnaire encompassed items divided into categories of diagnosis, treatment, and tools. Statistical analysis for internal and external validity, reliability, and other factors was conducted using SPSS.

Results: The questionnaire demonstrated high internal consistency (Cronbach's Alpha = 0.804, 0.879 for standardized items) and good test-retest reliability. Some items showed strong positive correlations, while a few indicated weaker correlations, revealing areas for potential refinement. The study highlighted significant correlations in most parameters, affirming the questionnaire's reliability.

Conclusion: This research successfully developed and validated the first Arabic-language questionnaire for assessing dentists' knowledge in managing deep caries cavities. The methodology ensured the tool's reliability and validity, with practical implications for dental education and practice in Arabic-speaking regions.

Keywords: Dental Caries, Caries, Attitudes, Practice, Questionnaire survey, Deep carious lesions, Validation study, Dentists.



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تطوير ودراسة استبيان مُصمم باللغة العربية لتقييم معرفة أطباء الأسنان وطريقة تدبير الآفات النخرية العميقة

رشاد محمد خير الغوراني¹، حسام محمود المللي²

¹ طالب ماجستير قسم مداواة الأسنان - كلية طب الأسنان - جامعة دمشق.

Rashad.gho@damascusuniversity.edu.sy

² أستاذ مساعد في قسم مداواة الأسنان - كلية طب الأسنان - جامعة دمشق.

milly.hussam@damasucsuniversity.day.sy

المخلص:

المقدمة: هناك علاقة وثيقة بين الصحة الفموية والصحة العامة وباعتبار أن النخر السني من أكثر الأمراض انتشاراً في العالم، لذلك من واجب أطباء الأسنان التعامل الصحيح مع هذه الحالات ابتداءً بالتشخيص وانتهاءً بالمعالجة بشكل علمي وحديث.

الهدف: اعتماد وتصميم استبيان باللغة العربية مُوجه لتقييم كفاءة وخبرة أطباء الأسنان بتشخيص ومعالجة الآفات النخرية العميقة.

المواد والطرائق: تضمنت الدراسة إجراء ترجمة وتعديل لاستبيان مُصمم بشكل مسبق، مع إضافة نقاط جديدة وعرضه على لجنة خبراء مكونة من ثلاثة أساتذة من قسم المداواة بجامعة دمشق، تضمنت العينة 20 طبيب من جامعة دمشق قاموا بتعبئة الاستبيان لإجراء اختبار وإعادة اختبار تتضمن الاستبيان أسئلة عن التشخيص وخطة المعالجة والأدوات المستخدمة أثناء المعالجة.

تم إجراء اختبارات الإحصاء لتقييم الاتساق الداخلي والخارجي للاستبيان عن طريق برنامج SPSS
النتائج: أظهر الاستبيان اتساق داخلي عالي (Cronbach's Alpha = 0.804, 0.879) ومصدقية عالية، بينما كان هناك بعض النقاط التي تحتاج لتعديل وتوضيح.

الاستنتاجات: قيمت هذه الدراسة وطورت الاستبيان الأول باللغة العربية لتقييم معرفة أطباء الأسنان حول طريقة تدبير الآفات النخرية العميقة.

الكلمات المفتاحية: النخور السنية، نخور، ممارسة، استبيان، دراسة مسحية، آفات نخرية عميقة.

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Introduction:

The intricate relationship between oral health and overall systemic well-being is a focal point in modern medical research. Oral health, particularly the management of dental caries, is a critical component of this relationship [1]. Dental caries, stand as one of the most common oral diseases worldwide, affecting a significant portion of the global population [2]. This underscores the need for dental professionals to have a profound understanding of the challenges involved in diagnosing and treating these conditions effectively [2]. The complexities of managing deep caries are crucial in both general and specialized dental practices due to their potential systemic implications and the technical skill required for treatment [3].

The oral cavity hosts a diverse microbiome crucial for both oral and systemic health. Microbial dysbiosis, or an imbalance in this microbiota, can contribute to various systemic diseases. Research has demonstrated that oral conditions are linked to systemic conditions such as cardiovascular, respiratory, gastrointestinal, and diabetic complications. Consequently, managing oral diseases like deep caries is vital not only for oral health but also for general health [4].

Efforts to improve dentists' management of deep caries cavities have shown that approaches vary significantly with experience and education. A study of 216 pediatric dentists found that those with less than 10 years of experience preferred partial caries removal and techniques like the Hall technique, unlike their more experienced counterparts who favored complete caries removal. These differences underscore the necessity for consistent, updated training in treating deep carious lesions, especially in primary teeth [3].

Despite the critical role of effective deep caries management, there is a significant gap in assessing dentists' knowledge and skills, especially in Arabic-speaking regions. This deficiency underscores the necessity for a specialized Arabic-language tool to evaluate and enhance dentists' competencies in this area. Developing a comprehensive questionnaire for

these regions could substantially improve dental care quality and, consequently, the systemic health outcomes of patients. Such a tool would not only raise dental practice standards but also support the broader objective of integrated healthcare, emphasizing oral health as a crucial element of overall health.

This research aims to develop and validate a questionnaire specifically designed for Arabic-speaking dentists, focusing on their knowledge and skills in managing deep caries. This initiative is crucial in improving dental care quality and aligns with the global public health objective of integrating oral health into general healthcare, thereby addressing a critical aspect of overall well-being.

Aim of the research:

To create and validate the first Arabic questionnaire specifically for assessing dentists' competence in diagnosing and managing deep caries cavities.

Methods and materials:

Study Design: The development process involved the translation of existing questionnaires, the addition of new items by a group of experts, expert review of the translation, and statistical tests to measure internal and external validity, reliability, and other factors. A practical guideline to develop and validate questionnaires was followed [5].

Questionnaire Development: The questionnaire was adapted from previous studies, which was the foundation of this research. The study published by (Niemeyer *et al.*, 2023) focused precisely in developing and validation a questionnaire aimed at studying the dentists ability to manage root caries, which is similar in the methodology to our study, but different in the type of the caries, as we focused on deep caries cavities. While many other items were chosen from (koopaeiet *al.*, 2016) which focused precisely on assessing general dentists (GDs), pediatric dentists' (PDs), and endodontists' (EDs) diagnostic methods, clinical decision-making considerations, treatment strategies, and knowledge, behavior, and attitudes related to the diagnosis and treatment of DCLs.. The previous two research were

fundamental in the development of this study. All of the items included from the previous studies have been reviewed and improved by a panel of experts (HA,HA,MT) who have experience in dentistry and academic research which involve designing and validation of questionnaires. And based on that: 8 items were included, 7 items were modified, 3 items were deleted, 6 items were added. This process also involved a professional sworn translator (English-Arabic) to ensure accuracy in translation.

Questionnaire Translation and Cultural Adaptation: The questionnaire was translated into Arabic by an official sworn translator (ET) then translated back into English to make sure it is accurate. While cultural aspects were considered, no significant cultural adaptations were needed.

Study Participants: The study involved 20 participants, both general and specialized dentists, with ages ranging from 25 to 30 years. All participants were working or studying at Damascus University Faculty of Dentistry. The sample was gender-balanced between male and female participants. We adopted the sample size guidelines from (Whitehead *et al.*, 2016) for pilot studies, determining that 20 is the minimum acceptable number for sample size calculations in our context. This decision was influenced by the constraints of having a small total population of 40 eligible participants at the university, ensuring a high participation rate and sufficient data for reliable initial analysis.

Data Collection Procedure: The pilot questionnaire was printed and distributed by hand to participants in a controlled environment, free from distractions. This ensured the quality and consistency of the responses. Data collection was done in Damascus university in the period of 1st to 20th of January 2024.

Test-Retest Reliability: The test-retest methodology involved administering the questionnaire twice to the same group of participants within a two-week interval.

Statistical Analysis: SPSS v.22 was used to carry out statistical analysis. The following tests were applied:

Intra-class Correlation Coefficient (ICC): To measure the reliability of the questionnaire by assessing the consistency of responses between the initial test and the retest.

Cronbach's Alpha Test for Internal Consistency: To determine the cohesiveness of the questionnaire items and their ability to measure a single, unified concept.

Possible Bias and Management Strategies: To mitigate recall bias, a two-week interval was implemented between the first and second administrations of the questionnaire. Additionally, a sufficiently large sample size was used to ensure statistical power and reduce the impact of individual variances.

Ethical Considerations: Ethical approval for this study was obtained from the Ethical Committee at Damascus University (approval number is there). All participants provided informed consent, and measures were taken to ensure confidentiality and compliance with ethical standards. Participants names were coded with a serial number. **Results:**

Demographic variables of the sample:

The study's demographic profile encompassed gender distribution with 40% (8) of the participants being male and 60% (12) female. In terms of clinical experience, most of the participants, accounting for 85% (17), had less than five years of experience, while 15% (3) had between 5 to 10 years, and none had more than 10 years of experience. Regarding their specialty, a small fraction, 5% (1), were general dentists, 55% (11) specialized in endodontics, and the remaining 40% (8) belonged to other dental specialties. The age of the participants varied, with a mean age of 26.3 years, a minimum of 24 years, and maximum of 29 years, accompanied by a standard deviation of 1.3 years. Table

		Count	Table N %	Mean	Min	Max	SD
Gender	male	8	40.0%				
	female	12	60.0%				
Clinical experience	less than 5 years	17	85.0%				
	5-10 years	3	15.0%				
	more than 10	0	0.0%				
Specialty	general dentist	1	5.0%				
	endodontics	11	55.0%				
	other	8	40.0%				
Age				26.30	24.00	29.00	1.30

Test of internal consistency:

Case Processing Summary				Reliability Statistics		
		N	%	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Cases	Valid	20	.804	0.804	0.879	16
	Excluded	0	.0			
	Total	20	100.0			

The internal consistency of the questionnaire was evaluated using the Cronbach's Alpha test. The analysis included a total of 20 valid cases with no exclusions. The Cronbach's Alpha coefficient for the questionnaire, encompassing 16 items, was found to be 0.804. Additionally, when considering the standardized items, the Cronbach's Alpha value slightly increased to 0.879. Both values are higher than the commonly accepted threshold of 0.7, indicating good internal consistency for the questionnaire. Table 2.

Test-Retest for questionnaire validity:

Overall, the Test-Retest analysis showed encouraging results, indicating good reliability of the questionnaire. Most of the items exhibited significant correlations, affirming the consistency of measurements over time. Notably, variables such as "Dentine hardness" (Pair 1) and "using of rubber dam" (Pair 4) demonstrated strong positive correlations of 0.947 ($p < 0.001$) and 0.730 ($p = 0.006$), respectively, underscoring their high

Table (3): reliability in assessing dental parameters.

Table 3 – test-Retest for questionnaire reliability						
			N	Correlation	P-value	Significance
Diagnosis	Pair 1	Dentine hardness	20	.947	.000	Significant
	Pair 2	Dentine color	20	.748	.033	Significant
	Pair 3	Do a radiograph before the treatment	20	1.000	.000	Significant
	Pair 4	rubber dam	20	.730	.006	Significant
	Pair 5	type of x-ray	20	.579	.007	Significant
	Pair 6	examining vitality	20	.579	.007	Significant
	Pair 7	how to test vitality	20	.676	.001	Significant
	Pair 8	treatment open apex	20	.740	.000	Significant
Treatment	Pair 9	in case of pulp exposure for teeth with open apex	20	.620	.004	Significant
	Pair 10	treatment closed apex	20	.616	.004	Significant
	Pair 11	in case of pulp exposure for teeth with closed apex	20	.774	.000	Significant
	Pair 12	treatment of non-reversible pulpitis open apex	20	.208	.378	Not significant
	Pair 13	treatment non-reversible with closed apex	20	.271	.249	Not significant
Tools used	Pair 14	tools for excavation	20	.926	.007	Significant
	Pair 15	materials used in case of pulp exposure	20	.846	.000	Significant
Factors to consider	Pair 16	Oral hygiene	20	.856	.003	Significant
	Pair 17	Age of patients	20	1.000	.000	Significant
	Pair 18	Patient compliance	20	1.000	.000	Significant

In the category of variables with moderate correlations, "Dentine color" (Pair 2) exhibited a noteworthy correlation coefficient of 0.748 ($p = 0.033$), indicating acceptable reliability. Additionally, "How to test vitality" (Pair 7) displayed a substantial positive correlation of 0.676 ($p = 0.001$), suggesting reliable measurement. Table 3

However, it is essential to acknowledge that some items showed no significant correlation, suggesting limitations in their reliability. Notably, "Treatment of non-reversible pulpitis not complete apex" (Pair 12) and "Treatment non-reversible with complete apex" (Pair 13) displayed weak correlations with coefficients of 0.208 ($p = 0.378$) and 0.271 ($p = 0.249$), respectively, indicating limited reliability in assessing these aspects. Table 3

Discussion:

The importance of training and assessing dentists' knowledge in the field of dental health is crucial, especially in terms of enhancing treatment outcomes [8]. This is particularly relevant when addressing prevalent and complex issues like deep

caries cavities. The gap in the availability of assessment tools, especially in Arabic, highlights a significant need for dental education and practice [9]. Our research addresses this gap, aiming to develop an Arabic-language tool for evaluating and improving dentists' understanding and management of deep caries cavities. This initiative is vital in regions where such resources are currently lacking, potentially transforming the approach to dental health care, and improving patient outcomes.

The methodology employed in this study aimed to create an Arabic questionnaire for evaluating dentists' knowledge in managing deep caries cavities. This was achieved through a 4 stages process of adapting and translating existing questionnaires, supplemented with expert input, developing the final version of the questionnaire, and statistical analysis using test-retest methods to ensure validity and reliability, including the use of Cronbach's Alpha and ICC [10]. This methodological framework was designed to ensure the questionnaire's effectiveness in a specific cultural and professional context [6].

The study sample included a dentist from Damascus university, gender was balanced, and the sample was

approached two weeks after the initial response which allowed to test the reliability of the questionnaire. The questionnaire's internal consistency, as indicated by the Cronbach's Alpha results, demonstrated good cohesion among the items. Both overall and standardized scores exceeded the accepted threshold, affirming the tool's reliability in assessing dentists' knowledge in this field. Furthermore, the test-retest analysis provided a nuanced view of the questionnaire's reliability. Significant correlations in most of the parameters indicated consistent responses over time. However, weaker correlations in some items, particularly concerning the treatment of non-reversible pulpitis, suggest areas for potential refinement and further investigation.

The results of the current study can be contextualized within the broader framework of dental research, particularly when compared to similar studies. For instance, the work of Niemeyer et al. (2023) involved creating a questionnaire to assess knowledge in diagnosing and managing root caries. Their approach mirrors our methodology in its comprehensive development and validation process [6]. In contrast, Schwendicke et al. (2013) focused on German dentists' approaches to deep dentin caries removal, revealing a strong preference for complete excavation. This contrasts with the findings of our study, where partial caries removal was more favored, especially among younger dentists, however, the aim of our study is to validate the questionnaire without going in depth regarding the answers of the dentist participated in the study [11]. Additionally, Carvalho et al. (2018) investigated Danish dental professionals' decision-making in occlusal caries management, showing significant agreement in treatment decisions, paralleling the consistency observed in our study. These comparisons underscore the regional and cultural differences in dental practices and attitudes, enriching the understanding of how dentists'

approaches to caries management may vary globally [12].

The clinical implications of this study are significant, particularly as it introduces the first questionnaire tailored for Arabic-speaking dentists to assess their knowledge in managing deep caries cavities. This tool represents a crucial step in understanding and improving dental care quality in Arabic-speaking regions. It can influence treatment decisions and patient outcomes by providing insights into current knowledge gaps and training needs [13]. The implementation of this questionnaire can also guide educational programs and professional development, ensuring that dentists are equipped with the latest knowledge and skills in deep caries management. The development of such a resource in Arabic fills a critical gap in dental education and practice, potentially leading to improved oral health outcomes in these communities [14].

Despite the challenging educational environment in Syria, this study successfully validated the first Arabic questionnaire for assessing dentists' knowledge in managing deep caries cavities. The methodology was carefully designed to mitigate potential biases and ensure reliability and validity. To avoid recall bias, a two-week interval between the first and second questionnaire administrations was implemented. This approach, along with the rigorous statistical analysis including Cronbach's Alpha and ICC, strengthened the reliability and validity of the findings, showcasing a resilient and effective research approach in a complex setting.

Conclusion:

This research successfully developed and validated the first Arabic-language questionnaire for assessing dentists' knowledge in managing deep caries cavities. The methodology ensured the tool's reliability and validity, with practical implications for dental education and practice in Arabic-speaking regions.

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