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Research Article

Factors Affecting the Diagnosis and Management of Occlusal Caries among Saudi Dentists Using the International Caries Detection and Assessment System

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Abstract

Objective: The process of detecting and diagnosing dental caries is considered a major challenge in dentistry due to various factors from the operator or from the clinical case that would affect the final diagnosis. The aim of this study was to define the factors that affect the diagnosis and management of occlusal caries among Saudi dentists using the International Caries Detection and Assessment System criteria.

Materials and methods: A self-administered questionnaire was randomly distributed to Restorative specialists, Pedodontists and general practitioners. The questionnaire had seven different colored clinical pictures that demonstrated various stages of occlusal caries, which represent the diagnosis and management of the occlusal caries system continuum as proposed by ICDAS committee. Contributors were given a list of diagnostic and management options from which to choose.

Results: A total of 340 questionnaires were distributed. The total response rate was approximately 88.82% (n = 302). The mean age of the participants was 29.7 ± 7.1 years. The number of male (n = 149) and female (n = 153) participants was almost equal. The majority of the respondents were general dentists (58%, n = 175), which was followed by restorative specialists (27%, n = 80) and then Pedodontic specialists (16%, n = 47). The mean number of correct answers for the diagnosis was highest for Pedodontic specialists, which was followed by Restorative specialists and General practitioners. However, the mean number of correct answers for management was highest for Restorative specialists, who was followed by General practitioners and Pedodontic specialists. One-way analysis of variance found no statistically significant difference between the groups with respect to the diagnosis and management, respectively (p = 0.180) (p = 0.099). The mean number of correct answers for both the diagnosis and management was highest among dental practitioners with over 11-25 years of experience after their last degree. Neither was statistically significant using one-way ANOVA (p = 0.136; p = 0.258).

Conclusion: A vast difference in the diagnosis and management was clearly evident in this study. Additionally, the two factors that most influenced the participant's ability for the diagnosis and management of occlusal caries were the specialty and years of experience.

Keywords: Bisphosphonate; BRONJ; Dentoalveolar; procedures; necrotic bone

Introduction

The World Health Organization (WHO) defined dental caries as a localized, post eruptive, pathological process of external origin involving softening of the hard tissue and proceeding to the formation of a cavity [1]. Dental caries is a multifactorial infectious disease of the calcified hard tissue of the teeth. It is caused by the presence and interaction of multiple factors, such as the host, agent, substrate and time [2].

The process of dental decay or dental caries begins when the interaction between the biofilm and tooth surface and subsurface begins. A carious lesion begins to progress when there is a disruption in the demineralization and remineralization equilibrium, which leads to the loss of minerals from the tooth surface and arrest of the remineralization process.

The process of detecting and diagnosing dental caries is considered a major challenge in dentistry due to various factors, ranging from the operator or from the clinical case that would affect the final diagnosis. Visual tactile examination, radiographic examination, fluorescence-based methods, and electrical conductance measurements are methods used to detect caries. Visual inspection and radio-graphic examination are the two most commonly used methods in the daily dental clinical practice, but these two methods are consid-ered reliable in diagnosing dental decay in the advanced stages [3,4].

Extensive research has been performed to develop diagnostic systems that allow for the visual inspection of dental caries [5,6]. The plurality of these systems was validated using visual caries determination methods [7,8]. The development and refinement of visual systems, such as the International Caries Detection and Assessment System (ICDAS) and the Universal Visual Scoring System (UniViSS), was performed due to the need for clinically reliable caries detection methods [8-10]. These two systems diagnose dental caries based on visual inspection. Furthermore, the Decayed (D), Missed (M) and Filled (F) teeth (DMFT) index is an index that is used to assess the prevalence of dental caries as well as the dental treatment needs among the population [11]. It simply counts the number of decayed, missing (due to caries alone) and restored teeth even though it has been proven to be less accurate than the previously mentioned sys-tems [12]. There are many reasons for this, such as not using X-ray imaging in diagnosing caries; also, the index is not capable of diagnos-ing non-cavitated lesions, but it is used worldwide due to its acceptance and convenience. Other than the systems previously mentioned, there are many caries detection systems that use clinical and visual inspection methods. A systematic review has been conducted to describe these methods by Ismail., *et al*. 2004 [5].

An international group of cariologists and epidemiologists introduced The ICDAS in 2002 based on a systematic review of clinical caries detection systems to provide clinicians, epidemiologists, and researchers with an evidence-based, reliable system for caries detec-tion that would allow a certain level of standardization of data collection and enable better comparison between studies [13-15]. ICDAS was developed within two periods. ICDAS-I was introduced in 2003 and was based on the principle that any visual examination should be performed on clean, plaque-free teeth, after drying the lesion thoroughly to identify early lesions. These criteria suggested that the replacement of the traditional explorers and sharp probes with a ball-ended periodontal probe to avoid traumatic and iatrogenic defects on the incipient lesions.

Afterwards, in 2005, a modification was made, and the ICDAS-II was established at the ICDAS workshop in Baltimore. This improved modification focused mainly on exchanging the codes to insure that the system would enhance the detection of the severity [14,16]. Although the ICDAS-II has good reproducibility and accuracy for the detecting occlusal caries lesions at different stages of the disease [13,14,16-18], there are only few studies in the literature focusing on the visual ICDAS-II for occlusal caries detection.

This study aims to define the factors that affect the diagnosis and management process of caries among Saudi dentists using the ICDAS criteria.

Materials and Methods

Study Design and Sample Selection

The total number of dentists working in Saudi Arabia who are registered in the Saudi commission of health specialties was General practitioners = 3343, Restorative dentists = 300 and Pediatric dentists = 132.

A sample (General practitioners = 345, Restorative dentists = 169 and pediatric dentists = 98) was designed to represent the popula-tion of Saudi dentists working in Saudi Arabia. General practitioners and specialists in restorative and pediatric dentistry were randomly met in hospitals and dental clinics and were asked to fill out a self-report survey questionnaire. Sample size determination and random-ization were performed.

Survey Description

A sample (General practitioners = 345, Restorative dentists = 169 and pediatric dentists = 98) was designed to represent the popula-tion of Saudi dentists working in Saudi Arabia. General

practitioners and specialists in restorative and pediatric dentistry were randomly met in hospitals and dental clinics and were asked to fill out a self-report survey questionnaire. Sample size determination and random-ization were performed.

		Diagnosis	Treatment
Score 0		no caries	No treatment "Preventive"
Score 1		no caries	Remineralize "Preventive"
Score 2		Initial caries	Arrest "Preventive"
Score 3		Moderate caries	Sealant "Preventive"
Score 4		Moderate caries	Minimal surgical "Restorative"
Score 5		Extensive caries	Traditional surgical "Restorative"
Score 6		Extensive caries	Endodontic treatment "Restorative"

Table 1: (Diagnosis: 1- No caries, 2- Initial caries, 3- Moderate caries, and 4- Extensive caries)

(Management: 1- No treatment "preventive", 2- Remineralize "preventive", 3- Arrest "preventive", 4 – Sealant "preventive", 5- Minimal surgical "restorative", 6- traditional surgical "restorative", 7- Endodontic treatment "restorative")

Validity and specificity

To ensure the reliability and validity of the questioner, a pilot questionnaire was administered to twenty participants. The reliability and validity were tested by making the examiners repeat the same survey questionnaire after two weeks. The Cranach alpha for reliabil-ity was 0.820, indicating satisfactory reliability. Once the reliability and validity had been established, the questionnaire was distributed to the study population.

Ethical agreement

Ethical approval for this study was obtained from the research center at Riyadh Colleges of Dentistry and Pharmacy for the investigation.

Data Management

Data were checked for competence and consistency. A Statistical Package for Social Science (SPSS) for Windows, Version 16.0. Chi-cago, SPSS Inc. was used for data presentation (description of the sample by using the mean and standard deviation) and analysis (T-test for independent samples, One-way ANOVA and Pearson correlation were used to test the significance between parametric variables). All tests of significance were performed at the 5% level of significance.

Results

A total of 340 questionnaires were distributed. The total response rate was approximately 88.82% (n = 302). The demographic distribution of the participants is presented in figure 2, and the mean age of the participants was 29.7 ± 7.1 years. The number of male (n = 149) and female (n = 153) participants was almost equal (Table 2).

The majority of the respondents were general dentists (58%, n = 175), which was followed by restorative specialists (27%, n = 80) and then Pedodontic specialists (16%, n = 47). Eighty-five percent (n = 256) of the respondents gained their last degree from institu-tions in the Middle East. Half of the respondents worked full time in a university (50%, n = 152), which was followed by the ministry of health (15%, n = 45). The median year of graduation was 2009-2014, and the median year of experience after the last degree was 1-5 years (Table2).

Using the t-test for independent samples, a statistically significant difference was found between the gender and correct diagnosis (p = 0.003) and between the gender and correct management (p = 0.046) (Tables 3 and 4). The mean number of correct answers for males was more than females in both the diagnosis and management (Tables 3 and 4).

		Specialty						Total
		General practitioner		Restorative specialist		Pedodontic specialist		
		N	%	N	%	N	%	
Gender	Male	78	52.3	48	32.2	23	15.4	149
	Female	97	63.4	32	20.9	24	15.7	153
Total		175		80		47		302
Institute of the last degree	Middle East	161	62.9	67	26.2	28	10.9	256
	North America	3	15	9	45	8	40	20
	Europe	4	36.4	1	9.1	6	54.5	11
	Asia	6	46.2	3	32.1	4	30.8	13
	Africa	1	50	0	0	1	50	2
Total		175		80		47		302
Area of practice	Urban	166	57.6	76	26.3	46	15.9	288
	Rural	7	53.8	4	30.7	3	23.0	13
Total		173		80		49		302
Place or work "full time"	Ministry of health	16	35.6	20	44.4	9	20	45
	National Guard Health affairs	8	40	7	36.8	5	26.3	20
	Prince Sultan medical military city	11	30.6	15	41.7	10	27.8	36
	Security forces hospital	9	42.9	7	31.8	6	28.6	22
	King faisal specialist hospital & research centre	2	50	0	0	3	60	5
	University	116	76.3	24	15.8	12	7.9	152
	Private clinic	5	45.5	4	36.4	2	18.2	11
	Other	7	63.3	3	27.3	1	9.1	11
Total		174		80		48		302
Year of graduation	2014-2009	155	77.9	26	13.1	18	9	199
	2008-2003	4	8.7	30	65.2	12	26.1	46
	2002-1997	10	38.5	14	53.8	2	7.7	26
	1996-1991	1	6.7	4	26.7	10	66.7	15
	1990-1985	3	42.9	1	14.3	3	42.9	7
	1984-1979	1	12.5	5	62.5	3	33.3	9
Total		174		80		48		302
Years of experience after the last degree	Up to 5 years	156	70.0	43	19.3	24	10.8	223
	6-10	8	25	19	59.4	5	15.6	32
	11-15	6	30	9	45	5	25	20
	16-20	2	13.3	7	46.7	6	40	15
	21-25	3	42.9	1	14.3	3	42.9	7
	Other	0	0	1	20	4	80	5
Total		175		80		47		302

Table 2

The mean number of correct answers for diagnosis was highest for Pedodontic specialists, which was followed by Restorative specialists and General practitioners. One-way analysis of variance found no statistically significant difference between the groups (p = 0.180) (Table 3). However, the mean number of correct answers for management was highest for Restorative specialists, who was followed by General practitioners and Pedodontic specialists. One-way analysis of variance found no statistically significant difference between the groups (p = 0.099) (Table 4).

The mean number of correct answers for diagnosis was the lowest among dental practitioners who received their last degree from institutes in the Middle East and there was no statistical significance (p = 0.742) (Table 3). The mean number of correct answers for management was the third highest for dental practitioners who received their last degree from institutes in the Middle East, and there was no statistical significance (p = 0.687). One-way analysis of variance was used for testing significance (Table 4).

Using the t-test for independent samples, a statistically significant difference was found between the area of practice and correct diagnosis (p = 0.050) (Table 3). There was no statistically significant difference between the area of practice and correct management (p = 0.332). The mean number of correct answers of rural dental practitioners was more than the urban dental practitioners for both diagnosis and management (Table 4).

The mean number of correct answers for diagnosis was highest among dental practitioners in King Faisal Hospital and Private Clin-ics (Table 3). The mean number of correct answers for management was highest among dental practitioners in Prince Sultan medical military city. Neither was statistically significant using one-way ANOVA (p = 0.10; p = 0.070) (Table 4).

The mean number of correct answers for diagnosis was highest among dental practitioners who graduated from1979-1996 (Table 3). The mean number of correct answers for management was highest among dental practitioners who graduated from 1991-2002. Neither was statistically significant using one-way ANOVA (p = 0.351; p = 0.294) (Table 4).

The mean number of correct answers for both diagnosis and management was highest among dental practitioners with over 11-25 years of experience after their last degree. Neither was statistically significant using one-way ANOVA (p = 0.136; p = 0.258) (Tables 3 and 4).

The Pearson correlation between the correct diagnosis and management was positive and was statistically significant (p = 0.000) (Table 5).

Diagnosis of Correct Answers				
	N	**Mean**	**Std. deviation**	**p-Value**
Gender				
Male	149	4.73	1.250	0.003
Female	153	4.27	1.429	
Specialty				
General practitioner	175	4.38	1.488	0.180
Restorative specialist	80	4.65	1.192	
Pedodontic specialist	47	4.70	1.082	
Institute of the last degree				
Middle east	256	4.45	1.413	0.742
North America	20	4.85	.933	
Europe	11	4.55	1.214	
Asia	13	4.69	.947	
Africa	2	5.50	.707	
Area of practice				
Urban	282	4.45	1.342	0.050
Rural	11	5.27	1.849	
Place or work ‘‘full time ‘‘				
Ministry of health	45	4.60	1.214	0.10
National Guard Health affairs	19	4.79	1.134	
Prince Sultan medical military city	36	4.94	1.393	
Security forces hospital	21	4.43	1.028	
King Faisal specialist hospital &	4	5.00	.816	
research centre				
University	152	4.27	1.469	
Private clinic	11	5.00	1.095	
Other	11	4.82	1.168	
year of graduation				
2014-2009	199	4.42	1.481	0.351

2008-2003	46	4.46	.912	
2002-1997	26	4.62	1.499	
1996-1991	15	5.07	.884	
1990-1985	7	5.00	.816	
1984-1979	8	5.00	.756	
Years of experience after last degree				
Up to 5 years	223	4.41	1.392	0.136
6-10	32	4.41	.979	
11-15	20	4.80	1.609	
16-20	15	5.20	1.424	
21-25	7	5.29	.756	
Other	5	4.60	.548	
Total	302	4.50	1.361	

Table 3

Management of Correct Answers				
	N	**Mean**	**Std. deviation**	**p-Value**
Gender				
Male	149	3.06	1.425	0.046
Female	153	2.78	.910	
Specialty				
General practitioner	175	2.85	1.194	0.099
Restorative specialist	80	3.16	1.237	
Pedodontic specialist	47	2.77	1.108	
Institute of the last degree				
Middle east	256	2.94	1.206	0.687
North America	20	3.05	.826	
Europe	11	2.82	1.779	
Asia	13	2.46	.967	
Africa	2	3.00	1.414	
Area of practice				
Urban	282	2.91	1.170	0.332
Rural	11	3.27	2.054	
Place or work ''full time ''				
Ministry of health	45	3.07	1.232	0.070
National Guard Health affairs	19	2.95	.705	
Prince Sultan medical military city	36	3.47	1.748	
Security forces hospital	21	2.62	1.284	
King Faisal specialist hospital & research centre	4	3.00	1.155	
University	152	2.82	1.032	
Private clinic	11	3.18	1.250	
Other	11	2.45	1.128	
year of graduation				
2014-2009	199	2.89	1.218	0.294
2008-2003	46	2.85	.894	
2002-1997	26	3.27	1.564	
1996-1991	15	3.33	1.175	
1990-1985	7	2.71	.951	
1984-1979	8	2.38	1.061	
Years of experience after last degree				
Up to 5 years	223	2.86	1.126	0.258
6-10	32	2.88	.907	
11-15	20	3.15	1.663	
16-20	15	3.60	1.957	
21-25	7	3.14	.900	
Other	5	2.80	1.095	
Total	302	4.50	1.361	

Table 4

Correlations			
		Diagnosis Correct Answers	**Management Correct Answers**
Diagnosis Correct Answers	Pearson Correlation	1	.438**
	Sig. (2-tailed)		.000
	N	302	302
Management Correct Answers	Pearson Correlation	.438**	1
	Sig. (2-tailed)	.000	
	N	302	302

Table 5

Discussion

ICDAS II was established in Baltimore as a visual caries detection system. The advantage of this system is that it specified codes for developing dental caries, which offers different treatment options for each stage [14,16]. The findings from this paper provide insight into the factors that made the operator unable to diagnose and manage occlusal caries.

The present study followed the exact same criteria that were introduced by the ICDAS committee by focusing mainly on visual inspection, and the participants did not have previous training in the ICDAS system. Additionally, the cases were presented to them without further details or any additional verbal explanation, whereas the majority of the previous studies allowed previous training and other methods of diagnosis, such as tactile examination and histological sectioning of the sampled teeth [3,6,19]. The visual inspection and radiographic examination are the two most commonly used methods in the daily dental clinical practice in Saudi Arabia, which reflects positively on the accuracy of occlusal caries diagnosis and proper management in the country.

There is variation between dentists in how each specialist reaches a diagnosis and a line of treatment for any case. Moreover, both the medical and dental fields face variation in the decision-making process and management approach of diseases in general. This could be due to multiple factors, such as the constant updates in the medical/dental field, school the practitioner follows, years and place of experience, level of knowledge and personal preferences. This variation in the diagnosis and management was evident in this study as well as in previously conducted studies [5,6].

As mentioned earlier, the clinical cases used in this study had only one correct answer with respect to the diagnosis and management. It was also evident in the results that the pedodontic specialty dentists had the highest number of correct answers for diagnosing occlusal caries. This might be due to the special working circumstances that pedodontists face on a daily basis, such as dealing with anxious, uncooperative patients with a low tolerance to sitting still. All of these factors might aid in the development of pedodontists' diagnostic abilities. On the other hand, restorative specialty dentists had the highest number of correct answers in the management category, which could be due to their extensive studies about dental caries and how their work mainly revolves around treating caries and dental decay. Furthermore, they tend to be more updated with preventive and restorative approaches.

This study suggests that the specialty of the dentist plays an important role in their diagnosing and managing of dental caries and these findings are similar to those reported in a study conducted in Kuwait [6]. With respect to the place of work, dentists who work in the private clinics had the most correct diagnostic answers compared with dentists working in most government hospitals. This might be due to their well-organized appointment schedules, which eliminates the rush in the working time and allows them to have ample time to talk to the patients and correctly diagnose their cases. On the contrary, a study conducted in Kuwait showed no differences between dentists working in public clinics and dentists working in private clinics in terms of their accuracy in diagnosing occlusal caries [6].

The mean number of correct diagnosis and management answers varied with respect to where the last degree was obtained, which is due to the different educational background and working environments.

This study shows that the years of experience highly influences the accuracy of the diagnosis and management of occlusal caries, which is most likely due to the dentists' long working years and their high levels of exposure to many different cases, which improves their clinical skills. However, a previously performed study showed no significant correlation between the years of experience and ac-curate diagnosis and treatment of occlusal carious lesions [18].

Dentists who graduated in 1979-1996 had the highest number of correct answers in diagnosis, which might be because of their longer working experience. On the other hand, dentists who graduated in 1991-2002 were better at managing the cases, which could be because of the variety of preventive and restorative treatment approaches.

Visual inspection of occlusal caries is a good diagnostic tool that can be used as a screening method. Moreover, it is a more valid and reliable method to use dental tools, such as ball ended probes, to check for surface discontinuity and to prevent further damage of the lesion; if present, a dental mirror and other diagnosing tools, such as radiographs, to reach an accurate diagnosis could help contribute to the correct management of the case [15,18].

Conclusion

Within the limitations of this study, it was evident that the specialty and years of experience of the participants were the two main factors affecting the accuracy of diagnosis and management of occlusal caries.

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