

Original Article

Evaluating Caries Risk Assessment Practices among a Group of Egyptian Dental Interns Attending Pediatric Dentistry Rounds

Hadeel El-Refaey¹; Manal El Sayed¹; Ahmed Salama¹

¹Pediatric Dentistry Department ,Faculty of Dentistry, Cairo University, Cairo, Egypt.

Email: hadeel.mahmoud@dentistry.cu.edu.eg

Submitted: 31-10-2021

Accepted: 23-1-2022

Abstract

Aim: The present study aimed at evaluating the Caries Risk Assessment (CRA) practices among a group of Egyptian dental interns at the Pediatric Dentistry Department-Faculty of Dentistry-Cairo University.

Subjects and Methods: A four-section survey was used that comprised demographic information, assessment of knowledge, attitudes and caries management recommendations. Statistical analysis was performed by using SPSS version 24.

Results: The response rate was 93.8%. The present work revealed a satisfactory level of knowledge towards CRA among dental interns attending the pediatric dentistry rounds at Cairo University. However, differences existed between interns from governmental versus private universities regarding attitudes toward CRA especially in performing dental fillings and the availability of time to carry out the assessment. Moreover, a minority of interns attended the CRA workshop and the majority had scattered opinions regarding the management recommendations.

Conclusion: A satisfactory level of knowledge was revealed towards CRA among dental interns attending the pediatric dentistry rounds at Cairo University, however, based on their opinions regarding the management recommendations, a need for continuing dental education towards CRA and management is essential.

Keywords: Caries Risk Assessment; Prevention; Pediatric Dentistry; Dental Caries; Dental Education

1- Introduction

Dental caries represents a major public health problem worldwide and in developing countries like Egypt. In a study by Abbas et al., the prevalence of dental caries among Egyptian children was higher in primary dentition when compared to permanent

dentition.¹ Another study conducted among preschool children aged 3 - 6 years in Mansoura city, Egypt, reported a 61.4% prevalence rate of dental caries.²

The control of initiation and progression of the caries disease process is a universal target that necessitates the application of the international trend in caries

management which dictates the shift from the surgical approach towards a preventive, more conservative one.³

In order to track the caries disease process, a dentist must identify risk factors that will likely lead to the progression of the disease. This could only be established by caries risk assessment methods that became the mainstay for the successful implementation of a minimum intervention approach in treating dental caries.⁴

Caries risk assessment (CRA) for patients aged 6 year and older comprise multiple factors that, according to Caries Management by Risk Assessment (CAMBRA), were grouped into (1) disease indicators (clinical observations), (2) biological risk factors, and (3) protective factors.⁵ Similarly, for young children aged 0 to 5 years, a second CAMBRA caries risk assessment tool was developed.⁶

The assessment of a child's risk of developing caries became an essential component of any pediatric caries preventive program, as indicated by the American Academy of Pediatric Dentistry.⁷ From a legal perspective, dentists are required to document patient's risk status and keep evidence of patient education about risk factors and preventive recommendations.⁸

Accordingly, it is mandatory to estimate and analyze pediatric dentists' awareness and implementation of CRA to assist in clinical decision-making. Therefore, the present study was conducted to shed light on the knowledge, attitude, and practice (KAP) regarding CRA and management among a group of Egyptian dental interns at the Pediatric Dentistry Department-Faculty of Dentistry-Cairo University, graduated in 2018 or 2019, and acquired their education either in governmental or private dental schools in Egypt. To the best of our knowledge this is the first study to address CRA among dental interns in Egypt.

2- Subjects and Methods

2.1 Study Design

The study was registered with ClinicalTrials.gov (**Identifier: NCT03609034**)

The current descriptive, cross sectional study quantitatively measured knowledge, attitudes and practice behaviors regarding CRA and management among a group of 81 Egyptian dental interns who attended Pediatric Dentistry round in faculty of dentistry at Cairo University from August 2019 till January 2020. Undergraduate dental students, post graduate dentists and dental interns who refused to participate in the study were excluded from the study. A self-administered questionnaire was distributed among 81 dental interns chosen by convenience sampling technique. The questionnaire was framed in English language; it was based on three previous questionnaires, done in America, Iran and India with some modifications.

The questionnaire included 4 sections; first section consisted of 3 open-ended questions regarding personal information such as (Gender, university attended as an undergraduate student and year of graduation) in addition to one close-ended question (yes or no) regarding history of attending caries risk assessment (CRA) workshops. Second section was related to assessment of knowledge of dental interns toward caries risk assessment; it consisted of 11 close ended questions. (Yes or No items). One score is given for each response to items. Third section consisted of 10 close-ended questions (agree-disagree items) related to assessment of attitude of dental interns regarding caries risk assessment. Fourth section consisted of 6 close-ended questions, a 4 point Likert type scale⁹ (1=never, 2=sometimes, 3=frequently and 4=always) to rate the occurrence of caries management recommendations used in the practice setting.

Ethical approval for the study was obtained from the Research Ethics Committee, Faculty of Dentistry, Cairo University. Instructions to participants reminded them of their anonymity regarding survey responses.

2.2 Study Setting

The main researcher gave questionnaires to the dental interns to fill it out and then questionnaires were collected after 20 minutes. Dental interns were informed that they could ask about anything in the survey. All the answered questionnaires were collected at the same day, to prevent any of the participants to search for answers for the questions and then the answered questionnaires were subjected to data analysis.

2.3 Sample Size Calculation

A convenience sampling approach was used and the response rate was calculated. Based on 95% confidence level and 70.4 % precision of knowledge-based questions related to caries risk assessment among dental students at the University of California , San Francisco in USA, the sample size in this study was calculated by Medical Biostatistics Unit , Faculty of dentistry, Cairo University and estimated at 81 using a study by Calderón et al., 2007 ¹⁷ as a reference.

2.4 Statistical Analysis

Statistical analysis was performed by using statistical package for social science (SPSS) version 24. Data were presented as numbers and percentages; Chi-square test was used for comparison. Level of significance was calculated at $P \leq 0.05$

3- Results

Eighty-one dental interns participated in the current study, however only 76 were valid for statistical analysis (response rate = 93.8%), surveys with incomplete data were excluded. Demographic characteristics of the study subjects were presented in table 1 & figure 1, where female interns represented 60.5% while male interns 39.5%. 60.5% of interns received their dental education at Governmental Universities while 39.5% received their education at Private dental schools. Interns who attended CRA workshop accounted for 34.2% of total interns while the rest (65.8%) didn't attend any CRA workshops.

3.1 Knowledge scores

As seen in table 2, the majority of dental interns recognized the history of carious lesions within the past year, enamel radiographic approximal lesions and low socio-economic status as factors influencing the risk of caries in an individual (69.7%, 81.6% and 85.5% of interns respectively). Furthermore, 68.4% of interns considered white spot lesions as carious lesions and 90.8% believed *Streptococcus Mutans* contributes significantly in initiating carious lesions compared to lactobacillus.

In addition, almost all interns recognized the importance of diet counseling and the role of dietary habits in increasing the risk of caries and had the knowledge of the considerable role the salivary flow rate plays in caries process. On the other hand, 47.4% of dental interns failed to identify dental caries as a transmissible disease.

3.2 Attitude scores

Results of table 3 showed that most interns agreed on performing and explaining CRA results to patients as an integral part of dental practice (97.4% and 90.8% respectively). In addition, interns agreed on performing CRA to patients younger than 5 years (81.6%) and at 5-12 years of age (93.4%) as well as providing preventive counseling to patients in both age groups. Dental interns recognized that CRA is a predictor for possible development of future carious lesions (98.7%) and that untreated dental caries might result in health complications (68.4%).

On the other hand, 55.3% of interns reported that there was not enough time to perform CRA for each patient together with a considerable disagreement on providing dental restorations as a main caries management line (52.6%).

3.3 Practice behaviors and recommendations

According to the results of table 4, dental interns generally recommended fluoridated toothpaste compared to topical fluoride applications and pit and fissure sealant. On the other hand, dental interns' opinions were diverse regarding diet counseling and counseling for recall interval.

Table (1): Demographic characteristics

		Frequency (N)	Percentage (%)	Total N (%)
Gender	Male	30	39.5%	76 (100%)
	Female	46	60.5%	
Attending CRA workshop	Yes	26	34.2%	
	No	50	65.8%	
Year of Graduation	2018	35	46.1%	
	2019	41	53.9%	

4- Discussion

Caries risk assessment tools identify reliable predictors and allow dental practitioners to set protocols for determining the types and frequency of diagnostic, preventive, and restorative care targeting patient dental caries management. Dental CRA, based on a child's age, social/biological factors, protective factors, and clinical findings, should be a routine component of the new and periodic examinations performed by oral health care providers.⁷

Owing to the lack of information regarding awareness about CRA among dental interns in Egypt, the current study was planned and conducted to evaluate the level of knowledge, attitude and practice towards CRA in a group of Egyptian dental interns.

The present study reported a 93.8% response rate, where 76 questionnaires were statistically analyzed. This response rate was higher than rates reported in similar studies that adopted the mail surveying system where 62% response rate was reported in a survey by Trueblood and colleagues⁸ and 9% reported in the CRA survey for dental hygienist.¹⁰ This might be attributed to using face-to-face administration in the current study in contrast to mail surveying that usually yields lower response rates.¹¹

Concerning knowledge related questions, the majority of interns in the present study had clear knowledge about the factors influencing the risk of caries as the history of carious lesions in the past year,

enamel radiographic approximal lesions, the role of salivary flow rate, the low socioeconomic status as well as the impact of dietary habits in dictating the probability of caries in an individual.

However, surprisingly, almost half of the questioned dental interns (47.4%), regardless their CRA background or year of graduation, failed to identify dental caries as a transmissible disease, although most interns (90.8%), especially younger graduates and those who received their education in Governmental Universities, comprehensively recognized *Streptococcus Mutans* as a significant contributing factor in the initiation of carious lesions. A similar study by Goswami and colleagues, reported a higher percentage compared to the current study, where 87% of questioned Indian dentists in their study realized that dental caries is a transmissible disease.¹²

The discrepancy in response between the 2 studies could be explained by the fact that Goswami et al¹² in their study questioned pediatric dentists who are more clinically experienced and aware of caries risk indicators than dental interns in our study. It is worth mentioning that interns graduated from private dental schools showed a better knowledge (63.3%), albeit non-significant, regarding caries as a transmissible disease compared to interns who received their education in governmental universities (36.7%).

Table (2): Distribution & comparison between dental interns graduated in 2018-2019 from Governmental or Private universities who attended or didn't attend CRA workshop regarding Knowledge questionnaire

Knowledge statements		Gov.	Private	P- value	2018	2019	P- value	Non-	Attendees	P- value	Total
		Uni. N (%)	Uni. N (%)		Graduates N (%)	Graduates N (%)		Attendees N (%)	Attendees N (%)		N (%)
Dental caries is a transmissible disease	No	25 (54.3)	11 (36.7)	0.247	17 (48.6)	19 (46.3)	0.846	24 (48)	12 (46.2)	0.878	36 (47.4)
	Yes	21 (45.7)	19 (63.3)		18 (51.4)	22 (53.7)		26 (52)	14 (53.8)		40 (52.6)
Individuals with history of carious lesions within the past year are at high risk for future dental caries	No	16 (34.8)	7 (23.3)	0.037 *	11 (31.4)	12 (29.3)	0.838	18 (36)	5 (19.2)	0.131	23 (30.3)
	Yes	30 (65.2)	23 (76.7)		24 (68.6)	29 (70.7)		32 (64)	21 (80.8)		53 (69.7)
White spot lesions are considered carious lesions	No	13 (28.3)	11 (36.7)	0.772	11 (31.4)	13 (31.7)	0.979	15 (30)	9 (34.6)	0.681	24 (31.6)
	Yes	33 (71.7)	19 (63.3)		24 (68.6)	28 (68.3)		35 (70)	17 (65.4)		52 (68.4)
Individuals with history of restorations due to caries in the past 3 years are at low risk for future caries	No	23 (50)	16 (53.3)	0.579	18 (51.4)	21 (51.2)	0.985	26 (52)	13 (50)	0.869	39 (51.3)
	Yes	23 (50)	14 (46.7)		17 (48.6)	20 (48.8)		24 (48)	13 (50)		37 (48.7)
Enamel radiographic approximal lesions are considered disease indicators	No	8 (17.4)	6 (20)	0.171	8 (22.9)	6 (14.6)	0.357	8 (16)	6 (23.1)	0.450	14 (18.4)
	Yes	38 (82.6)	24 (80)		27 (77.1)	35 (85.4)		42 (84)	20 (76.9)		62 (81.6)
Low socio-economic status does not increase an individual's risk for dental caries	No	39 (84.8)	26 (86.7)	0.215	30 (85.7)	35 (85.4)	0.966	43 (86)	22 (84.6)	0.871	65 (85.5)
	Yes	7 (15.2)	4 (13.3)		5 (14.3)	6 (14.6)		7 (14)	4 (15.4)		11 (14.5)
Streptococcus Mutans plays a more significant role in initiating carious lesions than Lactobacilli	No	1 (2.2)	6 (20)	0.001 *	6 (17.1)	1 (2.4)	0.027 *	2 (4)	5 (19.2)	0.029 *	7 (9.2)
	Yes	45 (97.8)	24 (80)		29 (82.9)	40 (97.6)		48 (96)	21 (80.8)		69 (90.8)
High caries risk and a low caries risk patient requires different regimen of treatment	No	3 (6.5)	1 (3.3)	0.998	3 (8.6)	1 (2.4)	0.233	3 (6)	1 (3.9)	0.690	4 (5.3)
	Yes	43 (93.5)	29 (96.7)		32 (91.4)	40 (97.6)		47 (94)	25 (96.1)		72 (94.7)
Salivary flow rate plays an important role in caries occurrence	No	0 (0)	0 (0)	Absolute Sig.	0 (0)	0 (0)	Absolute Sig.	0 (0)	0 (0)	Absolute Sig.	0 (0)
	Yes	46 (100)	30 (100)		35 (100)	41 (100)		50 (100)	26 (100)		76 (100)
Patients at moderate-high caries risk need counseling about role of sugary & starchy foods in increasing caries risk	No	1 (2.2)	0 (0)	1.000	0 (0)	1 (2.4)	0.352	1 (2)	0 (0)	0.468	1 (1.3)
	Yes	45 (97.8)	30 (100)		35 (100)	40 (97.6)		49 (98)	26 (100)		75 (98.7)
Current dietary habits are an important factor when deciding on a treatment plan for patients	No	0 (0)	0 (0)	Absolute Sig.	0 (0)	0 (0)	Absolute Sig.	0 (0)	0 (0)	Absolute Sig.	0 (0)
	Yes	46 (100)	30 (100)		35 (100)	41 (100)		50 (100)	26 (100)		76 (100)

N: Number; %: Percentage; Gov.: Governmental; P: Probability Level; *significant Difference

Table (3): Distribution & comparison of answers of dental Interns graduated in 2018-2019 from Governmental or Private universities who attended or didn't attend CRA workshop regarding attitude questionnaire

Attitude statements		Gov.	Private	P- value	2018	2019	P- value	Non- Attendees	Attendees	P- value	Total
		Uni. N (%)	Uni. N (%)		Grad. N (%)	Grad. N (%)		N (%)	N (%)		N (%)
Performing CRA is an integral part of dental practice	Disagree	0 (0)	2 (6.7)	0.000 *	1 (2.9)	1 (2.4)	0.910	1 (2)	1 (3.8)	0.633	2 (2.6)
	Agree	46 (100)	28 (93.3)		34 (97.1)	40 (97.6)		49 (98)	25 (96.2)		74 (97.4)
Untreated dental caries disease can lead to health complications	Disagree	16 (34.8)	8 (26.7)	0.001 *	10 (28.6)	14 (34.1)	0.602	16 (32)	8 (30.8)	0.913	24 (31.6)
	Agree	30 (65.2)	22 (73.3)		25 (71.4)	27 (65.9)		34 (68)	18 (69.2)		52 (68.4)
Caries management includes mainly providing dental restorations	Disagree	30 (65.2)	10 (33.3)	0.093	19 (54.3)	21 (51.2)	0.790	27 (54)	13 (50)	0.740	40 (52.6)
	Agree	16 (34.8)	20 (66.7)		16 (45.7)	20 (48.8)		23 (46)	13 (50)		36 (47.4)
There is enough time to perform CRA for each patient	Disagree	32 (69.6)	10 (33.3)	0.015 *	17 (48.6)	25 (61)	0.278	27 (54)	15 (57.7)	0.759	42 (55.3)
	Agree	14 (30.4)	20 (66.7)		18 (51.4)	16 (39)		23 (46)	11 (42.3)		34 (44.7)
Explanation of CRA results is necessary for each patient	Disagree	6 (13)	1 (3.3)	0.911	2 (5.7)	5 (12.2)	0.330	3 (6)	4 (15.4)	0.180	7 (9.2)
	Agree	40 (87)	29 (96.7)		33 (94.3)	36 (87.8)		47 (94)	22 (84.6)		69 (90.8)
CRA can predict whether a patient might develop new carious lesions in the future or not	Disagree	1 (2.2)	0 (0)	1.000	1 (2.9)	0 (0)	0.276	0 (0)	1 (3.8)	0.163	1 (1.3)
	Agree	45 (97.8)	30 (100)		34 (87.1)	41 (100)		50 (100)	25 (96.2)		75 (98.7)
CRA in patients younger than 5 years old	Disagree	8 (17.4)	6 (20)	0.060	4 (11.4)	10 (24.4)	0.146	12 (24)	2 (7.7)	0.082	14 (18.4)
	Agree	38 (82.6)	24 (80)		31 (88.6)	31 (75.6)		38 (76)	24 (92.3)		62 (81.6)
CRA for patients aged 5 to 12 years old	Disagree	3 (6.5)	2 (6.7)	0.057	2 (5.7)	3 (7.3)	0.779	3 (6)	2 (7.7)	0.778	5 (6.6)
	Agree	43 (93.5)	28 (93.3)		33 (94.3)	38 (92.7)		47 (94)	24 (92.3)		71 (93.4)
Providing preventive counseling to patients younger than 5 years old is necessary	Disagree	5 (10.9)	2 (6.7)	0.667	4 (11.4)	3 (7.3)	0.537	4 (8)	3 (11.5)	0.613	7 (9.2)
	Agree	41 (89.1)	28 (93.3)		31 (88.6)	38 (92.7)		46 (92)	23 (88.5)		69 (90.8)
Providing preventive counseling to patients aged 5 to 12 years old is necessary	Disagree	9 (19.6)	1 (3.3)	0.284	6 (17.1)	4 (9.8)	0.342	9 (18)	1 (3.8)	0.083	10 (13.2)
	Agree	37 (80.4)	29 (96.7)		29 (82.9)	37 (90.2)		41 (82)	25 (96.2)		66 (86.8)

CRA: Caries Risk Assessment; Gov.: Governmental; N: Number; %: Percentage; P: Probability Level; *significant Difference

Table (4): Distribution & comparison of answers of dental interns graduated in 2018-2019 from Governmental or Private universities who attended or didn't attend CRA workshop regarding their practice behavior towards CRA and management recommendations

Recommendations		Gov. Uni.	Private Uni.	P-value	2018 Grad.	2019 Grad.	P-value	Non-Attendees	Attendees	P-value	Total	
		N (%)	N (%)		N (%)	N (%)		N (%)	N (%)		N (%)	
		46 (100)	30 (100)		35 (100)	41 (100)		50 (100)	26 (100)		76 (100)	
Topical fluoride application (gel/varnish)	Never	11 (23.9)	4 (13.3)	0.205	9 (25.7)	6 (14.6)	0.333	11 (22)	4 (15.4)	0.872	15 (19.7)	
	Sometimes	25 (54.3)	13 (43.3)		16 (45.7)	22 (53.7)		24 (48)	14 (53.8)		38 (50)	
	Frequently	7 (15.2)	12 (40)		7 (20)	12 (29.3)		12 (24)	7 (26.9)		19 (25)	
	Always	3 (6.5)	1 (3.3)		3 (8.6)	1 (2.4)		3 (6)	1 (3.8)		4 (5.3)	
Fluoridated toothpaste	Never	4 (8.7)	3 (10)	0.749	5 (14.3)	2 (4.9)	0.500	5 (10)	2 (7.7)	0.220	7 (9.2)	
	Sometimes	11 (23.9)	10 (33.3)		8 (22.9)	13 (31.7)		10 (20)	11 (42.3)		21 (27.6)	
	Frequently	10 (21.7)	7 (23.3)		8 (22.9)	9 (22)		13 (26)	4 (15.4)		17 (22.4)	
	Always	21 (45.7)	10 (33.3)		14 (40)	17 (41.5)		22 (44)	9 (34.6)		31 (40.8)	
Pit and Fissure sealant	Never	6 (13)	8 (26.7)	0.041	6 (17.1)	8 (19.5)	0.126	7 (14)	7 (26.9)	0.023	14 (18.4)	
	Sometimes	25 (54.3)	8 (26.7)		*	19 (54.3)		14 (34.1)	28 (56)		5 (19.2)	33 (43.4)
	Frequently	9 (19.6)	11 (36.7)			5 (14.3)		15 (36.6)	10 (20)		10 (38.5)	20 (26.3)
	Always	6 (13)	3 (10)			5 (14.3)		4 (9.8)	5 (10)		4 (15.4)	9 (11.8)
Mouth Rinse	Never	4 (8.7)	2 (6.7)	0.668	3 (8.6)	3 (7.3)	0.468	4 (8)	2 (7.7)	0.440	6 (7.9)	
	Sometimes	14 (30.4)	5 (16.7)		10 (28.6)	9 (22)		15 (30)	4 (15.4)		19 (25)	
	Frequently	18 (39.1)	11 (36.7)		15 (42.9)	14 (34.1)		19 (38)	10 (38.5)		29 (38.2)	
	Always	10 (21.7)	12 (40)		7 (20)	15 (36.6)		12 (24)	10 (38.5)		22 (28.9)	
Diet Counseling	Never	7 (15.2)	3 (10)	0.405	4 (11.4)	6 (14.6)	0.689	6 (12)	4 (15.4)	0.541	10 (13.2)	
	Sometimes	13 (28.3)	10 (33.3)		10 (28.6)	13 (31.7)		16 (32)	7 (26.9)		23 (30.3)	
	Frequently	11 (23.9)	6 (20)		10 (28.6)	7 (17.1)		9 (18)	8 (30.8)		17 (22.4)	
	Always	15 (32.6)	11 (36.7)		11 (31.4)	15 (36.6)		19 (38)	7 (26.9)		26 (34.2)	
Counseling for recall interval	Never	10 (21.7)	3 (10)	0.351	6 (17.1)	7 (17.1)	0.888	9 (18)	4 (15.4)	0.898	13 (17.1)	
	Sometimes	19 (41.3)	6 (20)		13 (37.1)	12 (29.3)		15 (30)	10 (38.5)		25 (32.9)	
	Frequently	5 (10.9)	10 (33.3)		6 (17.1)	9 (22)		10 (20)	5 (19.2)		15 (19.7)	
	Always	12 (26.1)	11 (36.7)		10 (28.6)	13 (31.7)		16 (32)	7 (26.9)		23 (30.3)	

*N: Number; %: Percentage; Gov.: Governmental; P: Probability Level; *significant Difference*

Indeed, dental caries is clearly identified as an infectious and transmissible disease owing to the presence of bacteria colonizing the tooth surfaces. However, unlike most infectious diseases, caries is the result of an imbalance of the indigenous oral pathogens rather than a nonindigenous, exogenous ones.¹³

In the current study, the questioned interns proved well knowledgeable where two-third (68.4%)

perceived white spot lesions as carious lesions. This percentage was higher than that reported by Pakdaman and colleagues (61.2%) who conducted a similar study, though this was much expected as their study detect KAP of senior dental students towards CRA who might be less knowledgeable than dental interns.¹⁴ On the other hand, Goswami and colleagues¹² mentioned that half of the dentists questioned in their study, including Pedodontists, didn't recognize white spot lesions as carious lesions. This might be

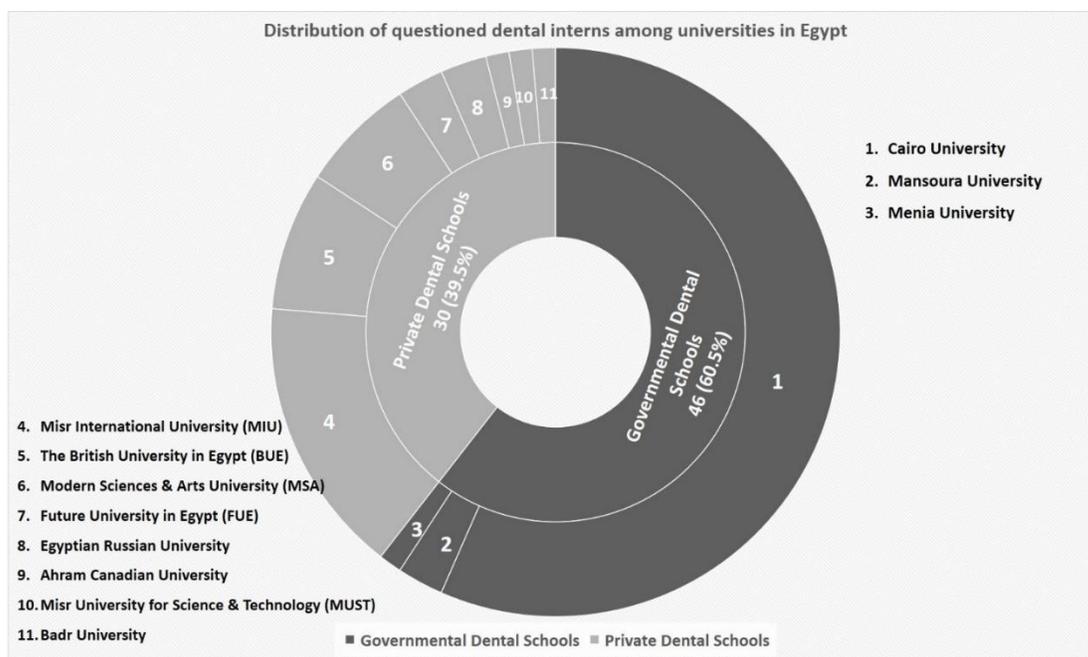


Figure1: showing distribution of questioned dental interns among universities in Egypt

further elucidated by the comprehensive didactic and clinical curriculum offered to dental students in Egypt that strongly emphasizes on the epidemiology, risk factors, prevention and management of caries in children, specially offered by the governmental universities. Albeit non-significant, percentage of interns well-informed about white spot lesions as carious lesions who received their education in governmental universities was higher than those graduated from private universities.

White spot lesions represent the earliest clinical sign in the process of tooth decay. At this stage, prior to cavitation, remineralization is the preventive strategy that can arrest or reverse the process.¹⁵ However, the inability of the dentist to recognize this stage may prevent him from offering minimally invasive services which aim at remineralization.¹² Therefore, the knowledge of white spots and their management is essential.

Regarding attitude towards CRA, the present study revealed a plain agreement on performing CRA and explaining its results for each patient by dental interns regardless their place of education, year of graduation or CRA workshop attendance. The results were in

accordance with a systematic review by Kumar et al. summarizing and reviewing studies with potential areas in dental health care settings using CRA and management. The authors stated that CRA has become the backbone of contemporary dental care practice relevant to all age groups, allowing clinicians to plan appropriate treatment modalities and preventive measures.¹⁶ There also existed a general agreement, in the current study, as to performing CRA and providing counseling for pediatric patients less than 5 years and at 5-12 years of age.

On the other hand, more than half of dental interns in the current study disagreed on providing dental restorations as the main line of therapy, this was in favor of interns graduating from governmental universities where 65% disagreed while almost 67% of interns graduating in private universities agreed. This difference, though non-significant, might highlight the weight given to updated knowledge, in didactic under-graduate curriculum, regarding management of caries in pediatric patients, in governmental universities. Moreover, the attitude of governmental universities' dental interns towards dental restoration might be explained by their exposure to more clinical skills and experience

offered by senior staff at the university dental hospitals, where the management of dental caries now is shifting to more conservative approach.

In fact, nowadays it is well established that surgical intervention of dental caries alone does not arrest the disease process and that tooth restorations have a delimited span. Accordingly, the management of dental caries has shifted to a more conservative approach that encompasses early detection of non-cavitated lesions, identification of risk factors, and active surveillance to apply preventive measures and observe carefully for signs of arrest or progression.⁷

In the same context, there existed a significant difference between interns receiving their education in governmental versus private universities in their attitudes regarding the presence of enough time to perform CRA, where 70% of interns from governmental universities believed there wasn't enough time to perform CRA for each patient, while 67% of interns of private universities thought there is actually enough time to conduct CRA. This result was indeed expected and can be further illustrated by the heavy flow of patients in governmental dental universities' hospitals that might hinder the process of performing CRA owing to time constraints.

The same opinion existed for dentists and Pedodontists in India regarding the lack of time to perform CRA where only 37% believed there is enough time for CRA.¹² On the other hand, dental hygienists' adopted a different point of view in the survey conducted by Francisco and colleagues to identify KAP among dental hygienists' regarding CRA in the US, where 71% reported having enough time to carry out CRA during an appointment, which is much predictable as dental hygienists are able to perform office-based CRA programs, being the fundamental preventive specialists in the dental team.¹⁰

With respect to the practice behavior and management recommendations towards CRA, dental interns specially of the governmental universities mostly recommended fluoridated toothpaste and

mouth rinse unlike interns from private universities and those attending CRA workshop who recommended pit and fissure sealant more frequently, and this result was statistically significant. This could be attributed to the sound appreciation of dental interns to the financial constraints of patients attending the governmental universities' dental hospitals seeking a high-quality low-priced service. That might be the reason why those dental interns chose to refrain from recommending a high-priced product in favor of a better-priced more available preventive measure.

In fact, it is widely agreed that the major barrier in the implementation, assessment, and utilization of the CRA tool is the need for patients to pay for the therapy. Indeed, in the teaching clinics of the School of Dentistry at the University of California San Francisco where CAMBRA was first implemented, the subset of patients whose therapy was covered by an insurance plan displayed a 38% reduction in caries increment.⁵

Finally, the American Academy of Pediatric Dentistry recommends CRA management protocols as essential elements of contemporary clinical care for infants, children, and adolescents, where they assist the dentist in clinical decision-making based upon child's age, caries risk, and patient compliance.⁷

5- Conclusions

- The present work revealed a satisfactory level of knowledge towards CRA among dental interns attending the pediatric dentistry rounds at Cairo University.
- Based on interns who attended the CRA workshop and based on the scattered opinions regarding the management recommendations in the studied group of Egyptian interns, a need for continuing dental education towards caries assessment and management is mandatory.

Acknowledgement

The authors would like to express their deepest gratitude to Dr. Yasmin M. Aboul-Ela, Lecturer, Clinical Pharmacology Department, Faculty of Medicine, Ain Shams University, for revising the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

References

- (1) Abbass, M. *et al.* (2019) 'The prevalence of dental caries among Egyptian children and adolescences and its association with age, socioeconomic status, dietary habits and other risk factors. A cross-sectional study', *F1000Research*, 8(8), pp. 1–19.
- (2) Mahmoud Shalan, H. and Mahmoud Abo Bakr, R. (2018) 'Oral Health Status of Preschool Children in Egypt', *Acta Scientific Dental Sciences*, 2(5), pp. 67–72.
- (3) Pitts, N. B. (2004) 'Are we ready to move from operative to non-operative/preventive treatment of dental caries in clinical practice?', *Caries Research*, 38(3), pp. 294–304.
- (4) Hallett, K. B. (2013) 'The application of caries risk assessment in minimum intervention dentistry', *Australian Dental Journal*, 58(SUPPL.1), pp. 26–34.
- (5) Featherstone, J. D. B. and Chaffee, B. W. (2018) 'The Evidence for Caries Management by Risk Assessment (CAMBRA®)', *Advances in dental research*, 29(1), pp. 9–14.
- (6) Ramos-Gomez, F. *et al.* (2007) 'Caries risk assessment appropriate for the age 1 visit (infants and toddlers)', *J Calif Dent Assoc*, 35(10), pp. 687–702.
- (7) American Academy of Pediatric Dentistry (2019) 'Caries-risk Assessment and Management for Infants, Children, and Adolescents', *Pediatric Dentistry*, 40(6), pp. 220–224.
- (8) Trueblood, R., Kerins, C. A. and Sue Seale, N. (2008) 'Caries risk assessment practices among texas pediatric dentistry', *Pediatric Dentistry*, 30(1), pp. 49–53.
- (9) Likert, R. (1932) 'A technique for the Measurement of Attitudes', *Archives of psychology*, 22(140), pp. 1–55.
- (10) Francisco, E. M. *et al.* (2013) 'Dental hygienists' knowledge, attitudes and practice behaviors regarding caries risk assessment and management', *Journal of dental hygiene*, 87(6), pp. 353–361.
- (11) Nulty, D. D. (2008) 'The adequacy of response rates to online and paper surveys: What can be done?', *Assessment and Evaluation in Higher Education*, 33(3), pp. 301–314.
- (12) Afshar, Marzieh *et al.* (2019) 'Knowledge, Attitude and Practice Regarding Caries Risk Assessment and Management in General Dentists- A Cross Sectional Survey', *Journal of Evolution of Medical and Dental Sciences*, 8(47), pp. 3499–3504.
- (13) Caufield, P. W. and Griffen, A. L. (2000) 'Dental caries: An infectious and transmissible disease', *Pediatric Clinics of North America*, 47(5), pp. 1001–1019. doi: 10.1016/S0031-3955(05)70255-8.
- (14) Pakdaman, A., Seyedjavadi, F. and Kharrazifard, J. (2014) 'Knowledge , Attitude and Self-Reported Practice of Senior Dental Students in Relation to Caries Risk Assessment', *Journal of oral health and dental management*, 13(4), pp. 1106–1110.
- (15) Featherstone, J. (2000) 'The science and practice of caries prevention', *Journal of the American Dental Association*. American Dental Association, 131(7), pp. 887–899.
- (16) Kumar, S., Somasundara Yale, S. and Sharma, V. (2019) 'Caries Risk Assesment : Utilization in Different Dental Care Setting - an Overview', *International Journal Science Research*, 8(4), pp. 20–21.
- (17) Calderón, S. H., Gilbert, P., Zeff, R. N., Gansky, S. A., Featherstone, J. D., Weintraub, J. A., & Gerbert, B. (2007). Dental students' knowledge, attitudes, and intended behaviors regarding caries risk assessment: impact of years of education and patient age. *Journal of dental education*, 71(11), 1420-14
- (18) Gordan, V. V., Riley III, J.L., Ajmo, C.T., Bockman, H., Jackson, M.B. & Gilbert, G.H. (2011). Dentists' use of caries risk assessment and individualized caries prevention for their adult patients: findings from The Dental Practice-Based Research Network. *Community Dent Oral Epidemiology*, 39 (6), pp.564–573.