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ANTIBIOTIC PROPHYLAXIS FOR BACTERIAL ENDOCARDITIS: A SURVEY OF CURRENT PRACTICES AMONG DENTISTS IN RIYADH

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ABSTRACT

The aim of this study was to evaluate the current practice of antibiotic prophylaxis for Bacterial Endocarditis (BE) among Riyadh dentists. A three-paged self-administered questionnaire was circulated to the dental practices in large hospitals and dental polyclinic in Riyadh City. A total of 700 questionnaires were distributed and the response rate was 41.7%. The relationship was determined between variables and the various responses using a X^2 test. A great majority ofthe respondents (96.9%) were using prophylactic antibiotic in patients susceptible to BE and amoxicillin was the first antibiotic of choice. A high percentage of the surveyed dentists were still using prophylactic antibiotic for low or negligible risk cardiac conditions. The respondents were also noticed to cover non-high risk dental procedures with prophylactic antibiotics. This practice is not consistent with the recent American Heart Association (AHA) guidelines. Therefore, improvement in dental practitioners knowledge about prophylactic antibiotic utilization is required.

Key words: *Bacterial endocarditis, antibiotic prophylaxis, dental practitioners*

NTRODUCTION

Since the initial realization ofBacterial Endocarditis (BE) as a fatal disease, efforts continue to improve the protection of endocarditis prone patients from bacteremia resulting from various dental measures. These efforts include a variety of prophylactic measures ranging from improving the dental hygiene of endocarditis-prone individuals to trials of different antimicrobial agents starting with sulfur-based antibiotics.' Several studies have been carried out about dental manipulations associated with high rates of bacteremia, reduction of bacteremia by antimicrobial agents and effectiveness of prophylactic antibiotics against bacteremia associated with dental procedures.[2-4] In late 1940's, penicillin became a preferred antimicrobial agent for prevention of BE.'

The first guidelines about the use of prophylactic antibiotics for BE were issued by the American Heart Association (AHA) in 1955.[6] These guidelines have since been regularly reviewed and revised as the new clinical or experimental evidence becomes available. The most recent guidelines were published in 1997.'

Due to the periodic changes in guidelines, confusion may exist among dental practitioners as to which guidelines are correct and most current. Several studies have been conducted to evaluate practice and/or compliance of dentists with the AHA guidelines for prevention of BE; mostly showing a low compliance.[8-15] The dental community must have up-to-date information about the latest guidelines on the use of antibiotic prophylaxis for BE. However, there are no published data on the use of prophylactic antibiotic by dentists in

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Riyadh. Therefore, the aim of the present study was to evaluate the current practices of prophylactic antibiotic use by Riyadh dentists.

MATERIALS AND METHODS •

A three-paged self-administered questionnaire was circulated to the dental practitioners in large hospitals and dental polyclinics in Riyadh City, with an explanatory letter requesting participation as well as ensuring anonymity. The questionnaire was pre-tested among a group of dentists not participating in the main study, and appropriate alterations were made. The questionnaire collected information in the following areas:

- Socio-demographic detail (age, gender, year of graduation, years of experience after graduation, highest professional degree, area of specialization, and place of work).
- Use of prophylactic antibiotics to prevent bacterial endocarditis; first antibiotic of choice, its alternative if the patient is allergic to the first choice and the time of administration.
- Use of a supplementary antibiotic or increasing the present penicillin dose in patients who take penicillin continuously for prevention of recurrent rheumatic fever.
- The prophylactic antibiotic of choice for patients allergic to penicillin and who are unable to take oral medications.
- The cardiac conditions that require antibiotic prophylaxis, and dental procedures which necessitate the prophylaxis for bacterial endocarditis.
- Main source of information regarding the prophylactic antibiotic use.

For most of the above-mentioned questions, the participants were given three to four choices to select the appropriate answer. The participants were given a list of eight cardiac conditions and 14 dental procedures, and were asked to select "yes", "no" or "I don't know" regarding the need of prophylactic antibiotic coverage before dental treatment in these situations.

All the data were entered into a computer using FOXPRO program, and a data file was generated. Various frequencies were derived using Statistical Package for Social Science (SPSS Version 10). The relationship was determined between variables such as gender, type of work, place of work, years of experience and the various responses using a X^2 test

RESULTS

Out of the 700 questionnaires that were distributed, 292 (157 males and 135 females) replies were received, giving a response rate of 41.7%. The respondents age ranged from 24-67 years (mean = 37.1 years, SD 7.8). The majority (54.8%) of the respondents were specialists while the remaining were general dental practitioners (45.2%). Slightly more than half (54.5%) of the respondents were from government hospitals. The years of experience ranged from 1-34 years (mean = 12.25 years, SD 7.96) with about two-thirds (73.8%) having £ 15 years of experience [Table 1].

A great majority of the respondents (96.9%) were using prophylactic antibiotics in patients susceptible to BE. Those not using prophylactic antibiotics in their practice included two General Practitioners, three Orthodontists, two Community Dentists, one Prosthodontist and one Operative Dentist. There was no difference in using prophylactic antibiotics in terms of gender, type of work, place of work, and years of experience [Table 2].

Amoxicillin was the first choice prophylactic antibiotic in 98.6% of the respondents while the others selected antibiotics such as gentamicin (0.4%), ciprofloxcin (0.7%), and vancomycin (0.4%) (Table 3). For patients allergic to penicillin, erythromycin was the first choice antibiotic for 52.7% of the respondemts, followed by clindamicin (45.5%) and Gentamicin (1.8%) with no one selecting vancomycin [Table 3].

In patients who take penicillin continuously for prevention of recurrent rheumatic fever, only 32.8% of the respondents selected the appropriate answer of using supplementary antibiotic, while 47.2% responded that they do not use any supplementary antibiotic, and 19.9% increase the penicillin dose before dental treatment [Table 3]. There was no statistically significant effect of any of the studied factors (gender, type of work, place of work, and years of experience) on any of the answers selected [Table 4 and 5]. For patients

TABLE 1: DEMOGRAPHIC DATA OF THE RESPONDENTS

Factor		N	%
Gender	Male	157	53.8
	Female	135	46.2
Type of work (degree)	GP	132	45.2
	SP	160	54.8
Place of work	Academic	69	23.6
	Government Hospitals	159	54.5
	Government Polyclinics	18	6.2
	Private Hospitals & Polyclinics	46	15.8
Years of experience	1-5	60	20.9
	6-10	74	25.7
	11-15	78	27.2
	16-20	39	13.5
	³21	37	12.5

N = number of respondents, GP= General Dentists, SP= Specialist Dentists

TABLE 2: PROPHYLACTIC ANTIBIOTIC USE BY DEMOGRAPHIC FACTORS

Use of antibiotic prophylaxis for bacterial endocarditis					
Factors		**Yes**	**No**	**Total**	***P-value***
Gender	Male	152 (96.8%)	5 (3.2%)	292	*0.913*
	Female	131(97%)	4(3%)		
Type of work (degree)	GP	129(98.5%)	2(1.5%)	290	*0.160*
	SP	152(95.6%)	7(4.4%)		
Place of work	Academic	64(92.8%)	5(7.2%)	292	*0.086*
	Government Hospitals	156(98.1%)	3(1.9%)		
	Government Polyclinics	17(94.4%)	1(5.6%)		
	Private Hospitals & Polyclinics	46 (100%)			
Years of experience	1-5	60(100%)	—	287	*0.282*
	6-10	70(94.6%)	4 (5.4%)		
	11-15	74(96.1%)	3(3.9%)		
	16-20	37(94.9%)	2 (5.1%)		
	³21	37(100%)	—		

TABLE 3: PROPORTIONS OF RESPONDENTS WITH CORRECT ANSWERS FOR THE QUESTIONS #2-6

	Questions	**Correct Answers**	
Q#2	What is your first prophylactic antibiotic of choice?	Amoxicillin	276(98.6%)
Q#3	Your alternative antibiotic if the patient is allergic to first choice?	Clindamycin or Erythromycin	274(98.2%)
Q#4	Your decision in patients who take penicillin continuously for prevention of recurrence of rheumatic fever?	Another antibiotic	89(32.8%)
Q#5	Your antibiotic of choice for patients allergic to penicillin and unable to take oral medications.	Clindamycin	146(59.1%)
Q#6	Time of administration?	One hour before procedure	192(70.1%)

TABLE 4: DIFFERENCES BETWEEN CORRECT ANSWERS IN TERMS OF GENDER AND TYPE OF WORK FOR THE QUESTIONS #2-6

Questions	Gender				Type of Work (Degree)			
	M	**F**	*N*	*P-value*	**GP**	**SP**	*N*	*P-value*
Q#2 What is your first prophylactic antibiotic of choice?	149 (98.7%)	127 (98.4%)	*280*	*0.874*	126 (97.7%)	150 (99.3%)	*280*	*0.242*
Q#3 Your alternative antibiotic if the patients is allergic to first choice?	148 (97.4%)	126 (99.2%)	*279*	*0.248*	127 (99.2%)	147 (97.4%)	*279*	*0.241*
Q#4 Your decision in patients who take pencillin continuously for prevention of recurrence of rheumatic fever?	48 (32.2%)	41 (33.6%)	*271*	*0.808*	36 (29%)	53 (36.1%)	*271*	*0.220*
Q#5 Your antibiotic of choice for patients allergic to pencillin and unable to take oral medications.	91 (64.5%)	55 (51.9%)	*247*	*0.045**	74 (63.2%)	72 (55.4%)	*247*	*0.209*
Q#6 Time administration?	106 (72.6%)	86 (67.2%)	*274*	*0.329*	88 (69.3%)	104 (70.7%)	*274*	*0.*793

N=number of respondents, *Significant difference (P£0.05)

allergic to penicillin and unable to take oral medications; 59.1% of the respondents answered correctly and selected Clindamicin as a prophylactic antibiotic of choice; the remaining selected other antibiotics such as erythromycin (21.1%), nafcillin (1.6%) and gentamicin (18.2%) [Table 3]. More males (64.5%) selected the correct answer than female (51.9%); and the difference was statistically significant *(P<0.05)* [Table 4 & 5].

"One hour before dental treatment" was the time selected by 70.1% of the respondents for the administration of prophylactic antibiotic [Table 3], while other respondents used different routines such as "one hour before and 6 hours after treatment" (24.1%); "24 hours before dental treatment" (4.7%) and "use of antibiotic for one week after treatment(1.1%). A statistically significant difference (P<0.05) was found between private hospitals and polyclinics and other places ofwork, as only 47.6% of respondents in the private sector administer the prophylactic antibiotic at appropriate time compared to 65.6%, 77.5%, and 76.5% for academic institutions (65.6%), government polyclinics (76.5%) and government hospitals (77.5%) [Table 4 and 5]. Another significant difference was found in terms of years of experience, as respondents having ³21 years of experience gave the minimum percentage of appropriate answer (55.6%) followed by the 11-15 years group (60.3%) as compared to 1-5 years and 6-10 years experience who gave 85% and 78.5% correct answers respectively [Table 4 and 5] .

For the four cardiac conditions that should be covered with prophylactic antibiotic before dental treatment according to the AHA (high risk), the highest percentage of correct answers were given for the conditions "prosthetic cardiac valves, including bioprosthetic & homograft valves" (76.1%) and "previous bacterial endocarditis", (95.7%); while only 66.3% and 64.8% correct answers were given to the cardiac conditions "complex cyanotic congenital heart disease" and "surgically constructed systemic pulmonary shunts" respectively [Table 6]. Only 46.6% of the respondents answered correctly for all the four cardiac conditions. There were no differences of the results in terms of any of the studied factors [Table 8 and 9].

TABLE 5: DIFFERENCES BETWEEN CORRECT ANSWERS IN TERMS OF PLACE OF WORK AND YEARS OF EXPERIENCE FOR THE QUESTIONS #2-6

Questions		Place of Work						Years of Experience						
		Acad.	Govt. Hosp.	Govt. Poly.	Private Hosp. & Poly.	*N*	P value	1-5	6-10	11-15	16-20	≤ 21	*N*	Pvalue
Q#2	What is your first prophylactic antibiotic of choice?	62 (98.4%)	153 (99.4%)	16 (94.1%)	45 (97.8%)	*280*	*0.354*	58 (96.7%)	70 (100%)	73 (98.6%)	37 (100%)	35 (97.2%)	277	*0.474*
Q#3	Your alternative antibiotic if the patients is aller-gic to first	63 (98.4%)	151 (98.7%)	17 (100%)	43 (95.6%)	*279*	*0.506*	58 (96.7%)	70 (100%)	72 (100%)	3 (97.3%)	35 (94.6%)	276	0.181
Q#4	Your decision in patients who take penicillin continuously for prevention of recurrence of rheumatic fever?	19 (31.1%)	56 (37.6%)	5 (29.4%)	9 (20.5%)	*271*	*0.191*	17 (29.3%)	27 (40.3%)	21 (29.6%)	13 (37.1%)	11 (29.7%)	268	0.595
Q#5	Your antibiotic of choice for patients allergic to penicillin and unable to take oral medications	3 (50%)	82 (59.4%)	12 (80%)	27 (61.4%)	*247*	*0.210*	38 (66.7%)	40 (64.5%)	3 (59%)	16 (55.2%)	15 (41.7%)	245	0.146
Q#4	Time of administration?	42 (65.6%)	117 (77.5%)	13 (76.5%)	al (47.6%)	*274*	*0.002**	51 (85%)	51 (78.5%)	44 (60.3%)	24 (64.9%)	20 (55.6%)	271	0.003*

N=numberof respondents
*Significant difference (P<0.05)

Significant difference in time of administration
Place of Work: Private Hosp.& Poly. vs all others

Significant difference in time of administration
Years of Experience: 1.5 vs 11-15 +>"21
6-10 vs 11-15 + >"21

TABLE 6: LIST OF CARDIAC CONDITIONS THAT SHOULD BE COVERED WITH PROPHYLACTIC ANTIBIOTIC ACCORDING TO AHA RECOMMENDATIONS (HIGH RISK) AND THE RESPONDENTS' ANSWERS

Cardiac Condition20(High Risk)	**Yes (Correct)**	**No (Incorrect)**	**I don't know**	**Total**
Prosthetic cardiac valves, including bioprosthetic & homograft valves	268(96.1%)	3(1.1%)	8(2.9%)	279
Previous bacterial endocarditis	269(95.7%)	5(1.8%)	7(2.5%)	281
Complex cyanotic congenital heart disease	181(66.3%)	40(14.7%)	52(19.2%)	273
Surgically constructed systemic pulmonary shunts	177(64.8%)	31(11.4%)	65(23.8%)	273

TABLE 7: LIST OF CARDIAC CONDITIONS THAT ARE NOT RECOMMENDED FOR PROPHYLACTIC ANTIBIOTIC COVERAGE BY AHA (LOW RISK) AND THE RESPONDENTS' ANSWERS

Cardiac Conditions (Low Risk)	**Yes (Incorrect)**	**No (Correct)**	**I don't know**	**Total**
Previous coronary artery bypass graft surgery	118(43.1%)	127(46.4%)	29(10.6%)	274
Mitral valve prolapse without valvar regurgitation	89(32.7%)	130(47.8%)	53(19.5%)	272
Previous rheumatic fever without valvar dysfunction	136(49.1%)	107(38.6%)	34(12.3%)	277
Cardiac pacemakers (intravascular and epicardial) and implanted defibrillators	116(41.9%)	130(46.9%)	31(11.2%)	277

TABLE 8: DIFFERENCES BETWEEN CORRECT ANSWERS IN TERMS OF GENDER AND TYPE OF WORK FOR THE CARDIAC CONDITIONS THAT SHOULD AND SHOULD NOT BE COVERED WITH PROPHYLACTIC ANTIBIOTIC

Questions	Gender				Type of Work (Degree)			
	M	F	*N*	*P-value*	GP	SP	*N*	*P-value*
Prosthetic cardiac valves, including bioprosthetic & homograft valves	146 (97.3%)	122 (94.6%)	*279*	*0.494*	123 (96.1%)	145 (96.0%)	*279*	*0.885*
Previous bacterial endocarditis	148 (97.4%)	121 (93.8%)	*281*	*0.312*	122 (94.6%)	147 (96.7%)	*281*	*0.379*
Complex cyanotic congenital heart disease	99 (66.9%)	82 (65.6%)	*273*	*0.137*	81 (64.8%)	100 (67.6%)	*273*	*0.372*
Surgically constructed systemic pulmonary shunts	94 (64.4%)	83 (65.4%)	*273*	*0.181*	79 (63.2%)	98 (66.2%)	*273*	*0.872*
Previous coronary artery without valvar regurgitation	79 (53.7%)	48 (37.8%)	*274*	*0.030**	63 (49.2%)	64 (43.8%)	*274*	*0.504*
Mitral valve prolapse without valvar re-gurgitation	68 (46.9%)	62 (48.8%)	*272*	*0.130*	63 (50.8%)	67 (45.3%)	*272*	*0.125*
Previous rheumatic fever without valvar dysfunction	58 (39.2%)	49 (38.0%)	*277*	*0.729*	46 (36.2%)	61 (40.7%)	*277*	*0.716*
Cardiac pacemakers (Intravascular and epi-cardial) and implanted defibrillators	76 (51.4%)	54 (41.9%)	*277*	*0.219* (46.1%)	59 (47.7%)	71	*277*	*0.951*

N=number of respondents, *Significant difference (P<0.05)

For the four cardiac conditions that are not recommended to be covered with prophylactic antibiotic by the AHA (low risk), more than 50% of the respondents either failed to give correct answers or checked the "I don't know" answer. Only 18.7% of the respondents answered appropriately for all the four conditions.

For the cardiac condition; "previous coronary artery bypass graft surgery"; a significant difference (P<0.05) was found between males and females, as more males (53.7%) gave appropriate answers than females (37.8%) (Table 8). Another significant difference was found between 16-20 years and >21 years experience groups, as 16-20 years experience group gave the minimum percentage of appropriate answers (25.0%) compared to the maximum percentage (55.6%) given by >21 years group [Table 9]. For the cardiac condition "mitral valve prolapse without valvar regurgitation" the only significant difference was found between academicians and dentists working in government polyclinics as 70.6% of the government polyclinics gave appropriate answers compared to 38.7% of the academicians [Table 9] .

For the seven dental procedures that should be covered with prophylactic antibiotic in susceptible patients as per AHA recommendations; the percentage of correct answers ranged from 33.5% to 97.5%. The highest percentage of the correct answers was for "dental extraction", followed by "periodontal procedures including surgery, scaling and root planning, probing and recall maintenance", and "dental implant placement and re-implantation of avulsed teeth", while the lowest percentage of the correct answers was for the procedure "initial placement of orthodontic bands" (Table 10). Only 23.7% of the respondents answered appropriately for all the seven dental procedures. For the dental procedure "initial placement of orthodontic bands", a statistically significant difference ***(P<0.05)*** was found between 1-5 years and $^{3}_{21}$ years experience

TABLE 9: DIFFERENCES BETWEEN CORRECT ANSWERS IN TERMS OF PLACE OF WORK AND YEARS OF EXPERIENCE FOR THE CARDIAC CONDITIONS THAT SHOULD AND SHOULD NOT BE COVERED WITH PROPHYLACTIC ANTIBIOTIC.

Questions	Place of Work						Years of Experience						
	Acad.	Govt. Hosp.	Govt. Poly.	Private Hosp. & Poly.	*N*	P-value	1-5	6-10	11-15	16-20	*<21*	*N*	*P*-value
Prosthetic cardiac valves, including bioprosthetic & homograft valves	60 (95.2%)	149 (96.8%)	17 (100%)	42 (93.3%)	*279*	*0.280*	56 (94.9%)	68 (98.6%)	71 (97.3%)	36 (97.3%)	34 (91.9%)	276	0.805
Previous bacterial endocarditis	63 (98.4%)	148 (96.1%)	17 (100%)	41 (89.1%)	*281*	*0.295*	5869 (96.7%)	69 (98.6%)	67 (90.5%)	36 (97.3%)	% (97.3%)	278	0.417
Complex cyanotic congenital heart disease	39 (62369%)	102 (68%)	9 (52.9%)	31 (70.5%)	*273*	*0.654*	39 (65%)	40 (60.6%)	50 (69.4%)	27 (75%)	24 (64.9%)	271	0.694
Surgically construCted systemic pulmonary shunts	42 (67.7%)	93 (61.6%)	11 (64.7%)	31 • (72.1%)	*273*	*0.462*	34 (59.6%)	43 (63.2%)	48 (66.7%)	28 (75.7%)	22 (61.1%)	270	0.919
Previous coronary artery graft surgery	26 (41.9%)	op (39.7%)	7 (41.2%)	25 (56.8%)	*274*	*0.312*	31 (51.7%)	31 (47%)	36 (49.3%)	9* (25%)	20* (55.6%)	271	0.049*
Mitral valve prolapse without valvar re-gurgitation	24* (38.7%)	77 (51.3%)	12* (70.6%)	17 (39.5%)	*272*	*0.045**	33 (56.9%)	37 (55.2%)	260 (40.3%)	13 (36.1%)	18 (48.6%)	270	0.119
Previous rheumatic fever without valvar dysfunction	22 (34.9%)	6:1 (39%)	8 (47.1%)	17 (39.5%)	*277*	*0.902*	23 (39%)	29 (42.6%)	28 (38.4%)	10 (27%)	16 (43.2%)	274	0.789
Cardiac pacemakers (intravascular and epicardial) and implanted defibrillators	25 (39.7%)	78 (51%)	8 (47.1%)	19 (43.2%)	*277*	*0.431*	*32* (53.3%)	*3560* (51.5%)	*29* (39.7%)	15 (41.7%)	19 (51.4%)	274	0.262

*N=numberofrespondents, *Significant* difference (P<0.05)

TABLE 10: LIST OF DENTAL PROCEDURES THAT REQUIRE PROPHYLACTIC ANTIBIOTIC COVERAGE AS RECOMMENDED BY AHA AND THE RESPONDENTS' ANSWERS

Dental Procedures	**Yes (Correct)**	**No (Incorrect)**	**I don't know**	**Total**
Dental extraction	271 (97.5%)	6 (2.2%)	1(0.4%)	278
Periodontal procedures including surgery, scaling and root planning, probing and recall maintenance	271(97.5%)	5 (1.8%)	2 (0.7%)	278
Dental implant placement and re-implantation of avulsed teeth	270 (97.5%)	3 (1.1%)	4 (1.4%)	277
Subgingival placement of antibiotic fibers or strips	177 (65.3%)	53 (19.6%)	41(15.1%)	271
Initial placement of orthodontic bands	92 (33.5%)	173 (62.9%)	10 (3.6%)	275
Intraligamentary local anesthetic injections	205 (74%)	54 (19.5%)	18 (6.5%)	277
Prophylactic cleaning of teeth or implants where bleeding is anticipated	228 (82.9%)	38 (13.8%)	9 (3.3%)	275

TABLE 11: DIFFERENCE BETWEEN CORRECT ANSWERS IN TERMS OF GENDER AND TYPE OF WORK FOR THE DENTAL PROCEDURE THAT SHOULD BE COVERED WITH PROPHYLACTIC ANTIBIOTIC

Questions	**Gender**				**Type of Work (Degree)**			
	M	**F**	***N***	***P-value***	**GP**	**SP**	***N***	***P-value***
Dental extraction	144 (96.6%)	127 (98.4%)	*278*	*0.191*	123 (96.1%)	148 (98.7%)	*278*	*0.325*
Periodontal procedures including surgery, scaling and root planning, probing and recall maintenance	146 (98%)	125 (96.9%)	*278*	*0.301*	123 (96.9%)	148 (98%)	*278*	*0.293*
Dental implant placement and re-implantation of avulsed teeth	146 (97.3%)	124 (97.6%)	*277*	*0.142*	122 (96.8%)	148 (98%)	*277*	*0.451*
Subgingival placement of antibiotic fibers or strips	92 (63.9%)	85 (66.9%)	*271*	*0.467*	80 (64.5%)	97 (66%)	*271*	*0.487*
Initial placement of ortho-dontic bands	51 (34.7%)	41 (32%)	*275*	*0.*795	33 (26.4%)	59 (39.3%)	*275*	*0.063*
Intraligamentarylocal anesthetic injections	107 (72.3%)	98 (76%)	*277*	*0.013**	94 (74%)	111 (74%)	*277*	*0.920*
Prophylactic cleaning of teeth or implants wher bleeding is anticipated	116 (78.4%)	112 (88.2%)	*275*	*0.007**	96 (76.8%)	132 (88%)	*275*	*0.046**

N=number of respondents, *Significant difference (P<0.05)

TABLE 12: DIFFERENCE BETWEEN CORRECT ANSWERS IN TERMS OF PLACE OF WORK AND YEARS OF EXPERIENCE FOR THE DENTAL PROCEDURES THAT SHOULD BE COVERED WITH PROPHYLACTIC ANTIBIOTIC

Questions	Place of Work						Years of Experience						
	Acad.	Govt. Hosp.	Govt. Poly.	Private Hosp. & Poly.	N	P-value	1-5	6-10	11-15	16-20	≤21	N	P-value
Dental extraction	€3 (98.4%)	148 (98%63	16 (94.1%)	44 (95.7%)	*278*	*0.732*	58 (96.7%)	66 (95.7%)	73 (98.5%)	36 (100%)	35 (97.2%)	275	0.527
Periodontal procedures including surgery, scalling and root plan-ning probing and recall maintenance	63 (98.4%)	148 (97.4%)	16 (94.1%)	44 (97.8%)	*278*	*0.741*	57 (96.6%)	67 (97.1%)	72 (97.5%)	36 (100%)	36 (97.3%)	275	0.894
Dental implant place-ment and re-implanta-tion of avulsed teeth	63 (98.4%)	148 (98%)	17 (100%)	42 (93.3%)	*277*	*0.519*	58 (98.3%)	69 (100%)	71 (95.9%)	35 (100%)	34 (91.9%)	274	0.063
Subgingival placement of antibiotic fibers or strips	40 (65.6%)	99 (66.9%)	10 (62.5%)	28 (60.9%)	*271*	*0.894*	42 (70%)	44 (65.7%)	48 (65.8%)	24 (70.6%)	19 (54.5%)	269	0.181
Initial placement of orthodonticbands	29 (46.8%)	41 (27.3%)	3 (17.6%)	19 (41.3%)	*275*	*0.066*	17* (28.8%)	24 (35.3%)	23 (31.1%)	12 (33.3%)	16 (44.4%)*	273	0.027*
Intraligamentarylocal anesthetic injections	49 (77.8%)	114 (75%)	12 (75%)	33 (65.2%)	*277*	*0.107*	48 (80%)	55 (80.9%)	52 (70.3%)	25 (69.4%)	23 (63.9%)	274	0.630
Prophylactic cleaning of teeth or implants where bleeding is anticipated	58 (90.6%)	120 (80%)	12 (75%)	38 (84.4%)	*275*	*0.098*	49 (81.7%)	54 (80.6%)	58 (79.5%)	34 (94.4%)	31 (83.8%)	273	0.594

*N=number of respondents, *Significant* difference

(P<0.05) 86

TABLE 13: LIST OF DENTAL PROCEDURES THAT DON'T REQUIRE PROPHYLACTIC ANTIBIOTIC COVERAGE AS RECOMMENDED BY AHA AND THE RESPONDENTS' ANSWERS

Dental Procedures	Yes (Incorrect)	No (Correct)	I don't know	Total
Restorative Dentistry (Operative & Prosthodontic) with or without retraction cord	80(29.5%)	179(66.1%)	12(4.4%)	271
Local anesthetic injection (non-intraligamentary)	83(30%)	183(66.1%)	11(4%)	277
Intracanal endodontic treatment	176(63.3%)	89(32.0%	13(4.7%)	278
Post placement and build-up	34(12.3%)	228(82.3%)	15(5.4%)	277
Placement of removable prosthodontic or orthodontic appliances	13(4.7%)	253(92.3%)	8(2.9%)	274
Placement of rubber dams	59(21.4%)	207(75%)	10(3.6%)	276
Taking of oral impressions	21(7.6%)	248(89.5%)	8(2.9%)	277

TABLE 14: DIFFERENCE BETWEEN CORRECT ANSWERS IN TERMS OF GENDER AND TYPE OF WORK FOR THE DENTAL PROCEDURES THAT SHOULD NOT BE COVERED WITH PROPHYLACTIC ANTIBIOTIC

Questions	Gender				Type of Work (Degree)			
	M	I F	*N*	*P-value*	GP	SP	*N*	*P-value*
Q#22: Restorative Dentistry (Operative & Prosthodontic) with or without retraction cord	105 (71.4%)	74 (59.7%)	*271*	*0.121*	88 (69.8%)	91 (62.8%)	*271*	*0.470*
Q#23: Local anesthetic injection (non-intraligamentary)	106 (71.6%)	*77* (59.7%)	*277*	*0.088*	93 (73.2%)	90 (60%)	*277*	*0.030**
Q#24: Intracanal endodontic treatment	58 (38.7%)	31 (24.2%)	*278*	*0.027**	38 (29.9%)	51 (33.8%)	*278*	*0.374*
Q#25: Post placement and build-up	132 (88%)	96 (75.6%)	*277*	*0.025**	108 (85.7%)	120 (79.5)	*277*	*0.256*
Q#26: Placement of removable prosthodontic or orthodontic appliances	136 (91.9%)	117 (92.9%)	*274*	*0.887*	118 (94.4%)	135 (90.6%)	*274*	*0.478*
Q#27: Placement of rubber dams	120 (81.1%)	87 68%)	*276*	*0.018**	96 (76.2%)	111 (74%)	*276*	*0.597*
Q#28: Taking of oral impressions	141 (94%)	107 (84.3%)	*277*	*0.014**	115 (91.3%)	133 (88.1%)	*277*	*0.688*

N=number of respondents, *Significant difference (P<0.05)

groups as 1-5 years experience group gave the lowest percentage of correct answers (28.8%) as compared to the highest percentage given by >21 years experience group (44.4%) [Table 12] .

A statistically significant difference ***(P<0.05)*** was found between males and females for the dental proce dure "intraligamentary local anesthetic injection" [Table 11] . However when the "No" and "I don't know" answers were joined, it was found that the difference between the correct answers for males and females was insignificant. For the dental procedures "prophylactic cleaning of teeth or implants where bleeding is anticipated", a statistically significant difference ***(P<0.05)***

TABLE 15: DIFFERENCE BETWEEN CORRECT ANSWERS IN TERMS OF PLACE OF WORK AND YEARS OF EXPERIENCE FOR THE DENTAL PROCEDURES THAT SHOULD NOT BE COVERED WITH PROPHYLACTIC ANTIBIOTIC

Questions	Place of Work						Years of Experience						
	Acad.	Govt. Hosp.	Govt. Poly.	Private Hosp. & Poly.	N	P-value	1-5	6-10	11-15	16-20	≤21	N	P-value
Q#22: RestorativeDentistry (Operative & Prosthodontic) with or without retraction cord	37 (58.7%)	% (67.1%)	12 (70.6%)	32 (71.1%)	*271*	*0.753*	44 (74.6%)	36 (55.4%)	54 (74%)	24 (68.6%)	20 (55.6%)	268	0.182
Q#23: Localanesthetic injection(non-intraligamentary)	42 (66.7%)	97 (63.8%)	14 (82.4%)	30 (66.7%)	*277*	*0.528*	46 (78%)*	45 (65.2%)	986 (62.2%)	25 (69.4%)	20 (55.6%)*	274	0.003*
Q#24: Intracanalendodontictreatment	21 (32.8%)	46 (30.5%)	5 (29.4%)	17 (37%)	*278*	*0.512*	17 (28.3%)	27 (39.1%)	24 (32.4%)	9 (25%)	12 (32.4%)	276	0.375
Q#25: Post placement and build-up	52 (81.3%)	120 (79.5%)	16 (94.1%)	40 (88.9%)	*277*	*0.405*	55 (91.7%)	55 (79.7)	58 (79.5%)	30 (83.3%)	29 (78.4%)	275	0.378
Q#26: Placement of removable Prosthodontic or Orthodontic appliances	57 (91.9%)	139 (92.1%)	17 (100%)	40 (90.9%)	*274*	*0.921*	58* (98.3%)	63 (91.3%)	66 (90.4%)	33 (94.3%)	31* (86.1%)	272	0.047*
Q#27: Placement of rubber dams	48 (76.2%)	107 (71.3%)	16 (94.1%)	36 (78.3%)	*276*	*0.547*	43 (72.9%)	49 (71%)	57 (77%)	30 (83.3%)	28 (77.8%)	274	0.214
Q#28: Taking of oral impressions	59 (92.2%)	131 (86.8%)	17 (100%)	41 (91.1%)	*277*	*0.431*	58 (96.7%)	60 (87%)	63 (86.3%)	32 (88.9%)	33 (89.2%)	275	0.199

N=numberof respondents, *Significant difference (P<0.05)

TABLE 16: DIFFERENT SOURCES OF INFORMATION ABOUT ANTIBIOTIC PROPHYLAXIS FOR BACTERIAL ENDOCARDITIS AND THE RESPONDENTS' PREFERENCE

Factors		**American Heart Ass.**	**European Society of Cardiology**	**Textbooks**	**Others**	**N**	**P-value**
Gender	M	93 (65%)	7 (4.9%)	39 (27.3%)	4 (2.8%)	*266*	*0.443*
	F	74 (60.2%)	3 (2.4%)	40 (32.5%)	6 (4.9%)		
Degree (Type of Work)	GP	60 (50%)	6 (5%)	46 (38.3%)	8 (6.7%)	*266*	*0.001 **
	SP	107 (73.3%)	4 (2.7%)	33 (22.6%)	2 (1.4%)		
Place of Work	Academic	43 (69.4%)	- (29%)	18 (1.6%)	1	*266*	*<0.0001 **
	Govt. Hosp.	101 (68.2%)	3 (2%)	38 (25.7%)	6 (4.1%)		
	Govt. Poly.	6 (35.3%)	1 (5.9%)	7 (41.2%)	3 (17.6%)		
	Private Hosp. & Poly.	17 (43.6%)	6 (15.4%)	16 (41%)			
Years of Experience	1-5	31 (51.7%)	1 (1.7%)	27 (45%)	1 (1.7%)	*263*	*0.305*
	6-10	45 (67.2%)	2 (3%)	16 (23.9%)	4 (6%)		
	11-15	41 (62.1%)	2 (3%)	21 (31.8%)	2 (3%)		
	16-20	23 (69.7%)	2 (6.1%)	7 (21.2%)	1 (3%)		
	< 21	24 (64.9%)	3 (8.1%)	8 (21.6%)	2(5.4%)		

N=number of respondents *Significant difference (P<0.05)

was found between males and females as more females (88.2%) answered appropriately than males (78.4%); and between general practitioners and specialists, as specialists gave higher percentage of correct answers (88.0%) than general practitioners (76.8%) [Table 11].

For the seven dental procedures that are not recommended for antibiotic coverage in susceptible patients by AHA, the percentage of correct answers ranged from 32.0% to 92.3%. The highest percentage (92.3%) was given for the dental procedure "placement of removable prosthodontic or orthodontic appliances" while the lowest percentage (32.0%) was given for the dental procedure "Intracanal endodontic treatment" [Table 13] . Only 21.3% answered appropriately for all the seven dental procedures. Statistically significant differences ($P<0.05$) were found between males and females for the following dental procedures; intracanal endodontic treatment, post placement and build-up, placement of rubber dams, and taking of oral impressions, as males tended to have higher percentage of correct answers than females [Table 14]. For the dental procedure "local anesthetic injection (non-intraligamentary)' ; significant differences ($P>0.05$) were found between general practitioners and specialists, as general practitioner's had higher percentage of correct answers (73.2%) than specialist (60.0%) (Table 14); and between 1-5 years and >21 years experience groups, as >21 years of experience group gave the lowest percentage of correct answers (55.6%) compared to the highest percentage given by 1-5 years group (78.%) [Table 15]. For the placement of removable prosthodontic or orthodontic appliances, a significant difference was found between 1-5 and >21 years experience group as 1-5 years of experience group gave higher percentage of correct answers (98.3%) than >21 years experience group (86.1%) [Table 15].

Regarding the source of information about prophylactic antibiotic for BE; about two-thirds of the respondents (62.8%) are using the AHA guidelines, followed by textbooks (29.7%), European Society of Cardiology Guidelines (3.8%) and others (3.8%) [Table 16] .

DISCUSSION

The present study has provided basic information on current practices of dentists in Riyadh for the use of prophylactic antibiotic to prevent BE. The results have highlighted the weak areas on the subject; and would assist in preparation and provision of appropriate information on prophylactic antibiotic use to the study population.

The majority of the surveyed dentists were using prophylactic antibiotic in patients susceptible to BE. Similarly, the majority of the respondents were using amoxicillin as the first choice of prophylactic antibiotics, meeting the required standards of practice, as amoxicillin has become corner stone for prophylactic antibiotic treatment, replacing penicillin V and ampicillin due to its better gastrointestinal tract absorption and higher and more sustained serum levels .[7,16] Similar results have been reported by several other recent studies.[13-15,17]

Despite the AHA (1997)[7] and the British Society for Antimicrobial Chemotherapy (BSAC) (1993)[18] recommendations that Clindamycin is the prophylactic antibiotic of choice in patients allergic to penicillin, replacing erythromycin because of its gastrointestinal side effects and complicated pharmacokinetics, erythromycin continues to be the preferred antibiotic of choice by the surveyed dentists in this study. The results are in agreement with several previous studies.[15,17]This could either be due to the AHA statement that "practitioners who have successfully used erythromycin for prophylaxis in individual patients may choose to continue with this antibiotic", or the respondents are still following the old recommendations.

The AHA in its last protocol of 1997[7] stated that "individuals who take an oral penicillin for secondary prevention of rheumatic fever or for other purposes may have viridans streptococci in their oral cavities that are relatively resistant to penicillin, amoxicillin or ampicillin and that practitioners should select other antibiotics such as clindamycin, azithromycin, or clarithromycin for endocarditis prophylaxis. Howevere, about two-third of the respondents were not following this recommendation. This result is also in agreement with other similar investigations." It seems as the recommendation to prescribe clindamycin instead of amoxicillin in these patients is poorly understood, resulting in increased risk of developing antimicrobial resistance and inappeoriate prevention of bacterial endocarditis. However, When asked about intravenous

route in patients allergic to penicillin and can't take oral medication, the majority of the respondents selected clindamycin as the prophylactic antibiotic of choice as recommended by AHA in 1997, because of its broad spectrum of activity against endocarditis causative microorganism.

Antibiotics administered prophylactically for the prevention of endocarditis act through multiple mechanisms including prevention of adherence to the endocardium and cidal activity once microbial division begins on the cardiac vegetations.[12] Administration of prophylactic antibiotic at the correct time is therefore crucial for protection. Dental procedures that produce a significant bacterimia should be undertaken when the antibiotic concentration is at its maximum. To reduce the likelihood of microbial resistance, it is important that prophylactic antibiotics be used only during the preoperative period and be administered shortly before a procedure. The antibiotic should not be continued for an extended period time because of the prolonged serum levels above the minimal inhibitory concentration of most oral streptococci and the prolonged serum inhibitory activity induced by amoxicillin against such strains .[7]

In this study an appropriate administration time (1 hour before treatment) was the most common practice among respondents. Epstein et al.[14] in a large survey performed in Canada found that more than 80% of general dental practitioners followed the current AHA prophylaxis protocol. This probably reflects the greater ease of compliance and simplicity of administration associated with the single-dose regimen compared to those previously used. On the contrary, Tomar-Carmona et al.[15] found in a survey among Spanish general dental practitioners that single-dose protocols was used by only 13.4% respondents. They also showed that the most frequent protocol used was that of the AHA from 1990 (1 hour before and 6 hours after). In the present study about one-fourth of the dentist are still applying this protocol, and majority of these are from the private sector which might be explained by limited continuing education in private clinics. Recent graduates (<10 years) used more appropriate timing of administration compared to the old graduates (>10 years). This might be due to unawareness of the old graduates about the latest recommendation.

A reasonable approach for endocarditis prophylaxis should consider the followings; (1) the degree to which the patient's underlying condition creates a risk of endocarditis; (2) the apparent risk of bacteremia with the procedure; (3) the potential adverse reactions of the prophylactic antimicrobial agent to be used and; (4) the cost benefits aspects of the recommended prophylactic regimen.' The AHA also stated that individuals who have high risk cardiac conditions are at a higher risk for developing severe endocardial infection that is often associated with high morbidity and mortality. In this study "prosthetic heart valves" and "previous endocarditis" were easily recognized by respondents as high risk conditions that should be covered with prophylactic antibiotics. Although the other two conditions "complex cyanotic congenital heart disease" and "surgically constricted systemic pulmonary shunt" are considered as high risk conditions by the AHA[7], about one-third of the respondents were not able to recognize these conditions as high risk. A study of antibiotic prescribing practices among Norwegian dentists by Preus et al.[11] revealed some shortcomings in the knowledge of the prophylactic use of antibiotics when treating patients with history of endocarditis. A high percentage of the surveyed dentist were still using prophylactic antibiotic for low or negligible risk conditions in spite of the fact that these patients have no greater risk than the general population as stated by AHA in 1997.[7] Such result call for improving the knowledge of studied dentists about the different categories of cardiac conditions. When there is doubt about the need for antibiotic prophylaxis in any patient, it is recommended that this patient is referred to a cardiologist for assessment of the need for prophylaxis. The cardiologist should be informed of the planned dental procedures and likelihood of causing bacteremia. Such a routine would reduce the need for unnecessary antibiotic prophylaxis and possibly simplify the patient's future treatment.[19,20]

Nelson and Van Blaricum[8] compared the compliance of physicians and dentists with AHA guidelines for prevention of BE and found that the physicians have a better understanding than dentists of the specific cardiovascular lesions requiring prophylaxis, while dentists have a better understanding than physicians of which dental procedures require antibiotic prophylaxis

in the at-risk patients. In the present study, well-known high risk dental procedures such as dental extraction, periodontal procedures, dental implant placements, and prophylactic cleaning of teeth were selected to be covered with antibiotic by majority of the respondents. However, lack of knowledge about other high risk procedures such as subgingival placement of antibiotic fibers or strips and initial placement of orthodontic bands was noticed among respondents. For the procedures, prophylactic cleaning of teeth or implants, females and specialist gave more percentage of correct answers than males and general practitioners respectively. The respondents were also noticed to cover non-high risk dental procedure such as intracanal endodontic treatment, non-intraligamentary local anaesthetic injection, restorative dentistry, and placement of rubber dams, with prophylactic antibiotic, possibly due to their assumption that these procedures are invasive while they are not according to AHA 1997 guidelines. It has been proposed that the dentist should be responsible for determining which dental procedures put the patient at risk for a bacteremia.[8] However, the practice of prescribing antibiotics for prophylaxis when uncertain was noticed in this study and other recent studies,[13,14] indicating a lack of awareness by health care professionals about the potential impact of such a practice on antibacterial resistance and the alarming increase in resistant infections. The implication of certain dental procedures or oral infections in the development of BE, the severity of this cardiological disease and severe legal repercussions call for knowledge on the updated guidelines of antibiotic prophylaxis for bacterial endocrditis.[15]

The AHA guidelines were the main reference for most of the respondents in this survey. However, discrepancies in prophylactic use of antibiotics for BE were noticed. Therefore, an improvement in dental practitioners' knowledge about prophylactic antibiotic utilization is required. This can be achieved through continuing education and wider dissemination of regularly updated AHA recommendations. Several other authors who studied the dentists' knowledge and compliance with AHA guidelines have made similar recommendations.[10–15]

The response rate was low in this study; which might have introduced some non-response bias in the results. Those with little knowledge about the subject might have chosen not to respond to the questionnaire or vice versa. The survey was conducted in one city, and may not reflect the practices of dentists in other cities of the Kingdom. Nevertheless, important base-line information has become available through the present study, with the ultimate goal of further broad based studies, and to develop national guidelines for the prevention of BE bearing in mind the rapidly developing antimicrobial resistance in the region.

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