Knowledge of infective endocarditis among dental students and interns in seven Nigerian Universities

[1]Abah A.A, [2]Soroye M.O.

[1]Department of Oral Pathology/ Oral Medicine, Faculty of Dentistry, Lagos State University
College of Medicine, Ikeja, Lagos. debowun@gmail.com
[2]Department of Preventive Dentistry, Faculty of Dentistry, University of Port Harcourt, College
of Health Sciences, Port Harcourt. docdupe@yahoo.com

Abstract:

Objective: Infective Endocarditis is a potentially life-threatening infection that could occur after an invasive dental procedure. It is usually associated with bacteria and high risk cardiac abnormalities. The depth of knowledge of infective endocarditic amongst dental students in developing countries is rarely reported and information relating to this is sparse in Nigeria. This study therefore aimed to determine the knowledge of IE amongst dental students and interns of Nigeria Universities.

METHODS: This cross-sectional study was conducted among dental students and interns of 7 Nigerian dental institutions using a self-administered questionnaire that captured biographic data, level of education, knowledge of Infective Endocarditis and sources of information. Data generated was analyzed using SPSS Windows version 20.

RESULT: Two hundred and thirty-one students participated in the study. There were 120 males and 111 females, with M: F, 1.08: 1. Mean age was 25.34 ± 3.60 years. The participants were mainly in the age range of 22-25 years. Two hundred and nine (90.5%) participants knew that patients with prosthetic heart valve need prophylactic antibiotics prior to an invasive dental procedure and 204 (88.31%) responded that a positive history of previous endocarditis warrants prophylaxis. More than half knew that restoration of caries with amalgam need no prophylaxis. Knowledge of the type of antibiotics to administer was fair but none knew the right dose and the time of administration.

CONCLUSION: Most participants had fair knowledge about conditions that require prophylactic antibiotics and the type of antibiotics. However, no one knew the dose and the time of administration.

KEYWORDS: Knowledge, infective endocarditis, dental students, antibiotic prophylaxis

INTRODUCTION: Infective endocarditis (IE) was first described by Lazare Riviere in 1646, and Osler applied the term malignant endocarditis because the disease was severely fatal. [1]

Infective Endocarditis is a life-threatening infection that could occur after invasive dental procedures (such as scaling and polishing, root planning or extraction.) and other surgical procedures involving the genitourinary or the gastrointestinal tract. They are usually associated with microorganisms and high risk cardiac abnormalities.[2] It is an infection of the heart endothelium and the valves secondary to damage to the cardiac endothelium. Micro-organisms such as bacteria and fungi then invade the platelet/ fibrin that is formed secondary to the damage. The structure of the vegetation impedes the penetration of phagocytic cells such as monocytes and granulocytes resulting in high count of microorganisms and IE[3] with a wide variety of clinical presentations. [4] The America Heart Foundation (AHA) proposed a guideline on the management of heart related conditions requiring prophylactic antibiotics which was reviewed in 2007. [5] These recommendations have been revised and amended from time to time on the basis of experimental animal models, pharmacokinetic studies, bacterial susceptibility studies, bacteria endocarditis series, studies of procedures-related bacteremia, and the efficacy of antimicrobial prophylaxis against bacteremia.[6] Most recent update of the guideline was in 2017[7].

IE can be caused by bacteria, fungi and less commonly rickettsiae, chlamydiae, mycoplasmas, and possibly virus.[8] The organism usually implicated in about 60% of cases is *Streptococcus viridans*[9] while involvement

Correspondence: Abah A.A
Department of Oral Pathology/ Oral Medicine,
Faculty of Dentistry,
Lagos State University College of Medicine,
Ikeja, Lagos.
debowun@gmail.com
08023390024

of *Staphylococcus* species have been on the increase. Studies showed that 10% of patients with risk factors such as previous history of infective endocarditis, prosthetic heart valve, developed infective endocarditis after undergoing invasive dental treatment.[10] Furthermore, in 13.7% to 20% of patients, the cause of IE is through microorganisms from the oral cavity.[6] With the combination of antimicrobial therapy and heart valve surgery, mortality was within 10-20 %[6]. Likewise, the mortality rate in IE has significantly reduced from 7-10% to about 3% in recent years[11]. However unnecessary antibiotic prescription may lead to drug resistance, adverse drug reactions and additional costs to patients. Therefore early surgery has become a mainstay in the treatment of cardiac conditions leading to IE.[12-15]

The depth of knowledge of infective endocarditis amongst dental students in developing countries is rarely reported and the information relating to this is sparse in Nigeria. The number of people undergoing cardiac surgeries for repair or replacement of cardiac valve is on the increase now, so an excellent knowledge of the condition is paramount among dental personnel and the students for a safe dental practice. Therefore, this study aimed to determine the knowledge of IE and awareness of choice of antibiotics for prophylactic use in infective endocarditis amongst dental students and interns of Nigeria Universities.

METHODS: This cross-sectional study was conducted among clinical dental students in their penultimate (500 Level) and final year (600 Level) and the interns (house officers) of seven Nigerian teaching hospitals: College of Medicine University of Lagos (CMUL), Lagos State University College of Medicine (LASUCOM), Obafemi Awolowo University Teaching Hospital (OAUTHC), University of Benin Teaching Hospital(UBTH), University of Port Harcourt Teaching Hospital (UPTH), University College Hospital, Ibadan(UCH) and University of Maiduguri Teaching Hospital(UMTH). Two hundred and thirty-one out of two hundred and forty-five responded with a response rate of 94.7%. The self-administered questionnaires were distributed at the various institutions by a representative from each school and couriered back to the authors, with final destination on the principal investigator's desk. Fourteen closed-ended and 6 opened ended questions were asked. The questionnaire captured biographic data, level of education, knowledge of Infective Endocarditis (cardiac conditions that are at risk, organisms implicated, dental procedures that can lead to IE without prophylaxis, the antibiotics, dose and when to be administered) and the source of information. The students were scored 'good' when the score was above 14 (15-20), 'fair' for 8-14 and 'poor', below 8 (0-7). Analysis was carried out using Statistical Package for Social Sciences for Windows version 20.0, SPSS Inc. Chicago IL. The mean of the dentists and students' knowledge about IE prophylaxis were calculated and the data was compared between the groups with ANOVA. Pearson's chi-square tests and Fischer's exact were

Table 1a : Mean comparison of percentage score according to demographic characteristics

Variable	Frequency (n=231)	Mean+SD	p-value
Age group (years)			0.062
≤21	17(7.4)	61.76±24.4	
22-25	123(53.2)	72.36±15.6	
26-29	74(32.0)	67.84±17.64	
≥30	17(7.4)	68.82±14.31	
Gender			
Male	120(51.9)	70.88±16.3	0.368
Female	111(48.1)	68.78±18.9	
Educational level			0.023*
500 Level	61(26.4)	64.59±21.7	
600 Level	113(48.9)	71.59±16.1	
Internship	57(24.7)	72.11±14.1	

*p-value significant

Table 1b:Association between knowledge on infective endocarditis and socio-demographic characteristics

	Poor	Fair	Good	p-value
Age group (years)				**0.035***
≤21	3(17.6)	6(35.3)	8(47.1)	
22-25	2(1.6)	38(30.9)	83(67.5)	
26-29	4(5.4)	25(33.8)	45(60.8)	
≥30	0(0.0)	8(47.1)	9(52.9)	
Gender				**0.400***
Male	3(2.5)	38(31.7)	79(65.8)	
Female	6(5.4)	39(35.1)	66(59.5)	
Educational level				**0.022***
500 Level	6(9.8)	25(41.0)	30(49.2)	
600 Level	2(1.8)	35(31.0)	76(67.3)	
Internship	1(1.8)	17(29.8)	39(68.4)	

*p-value significant

Figure 1: Overall knowledge score on infective endocarditis among students and interns
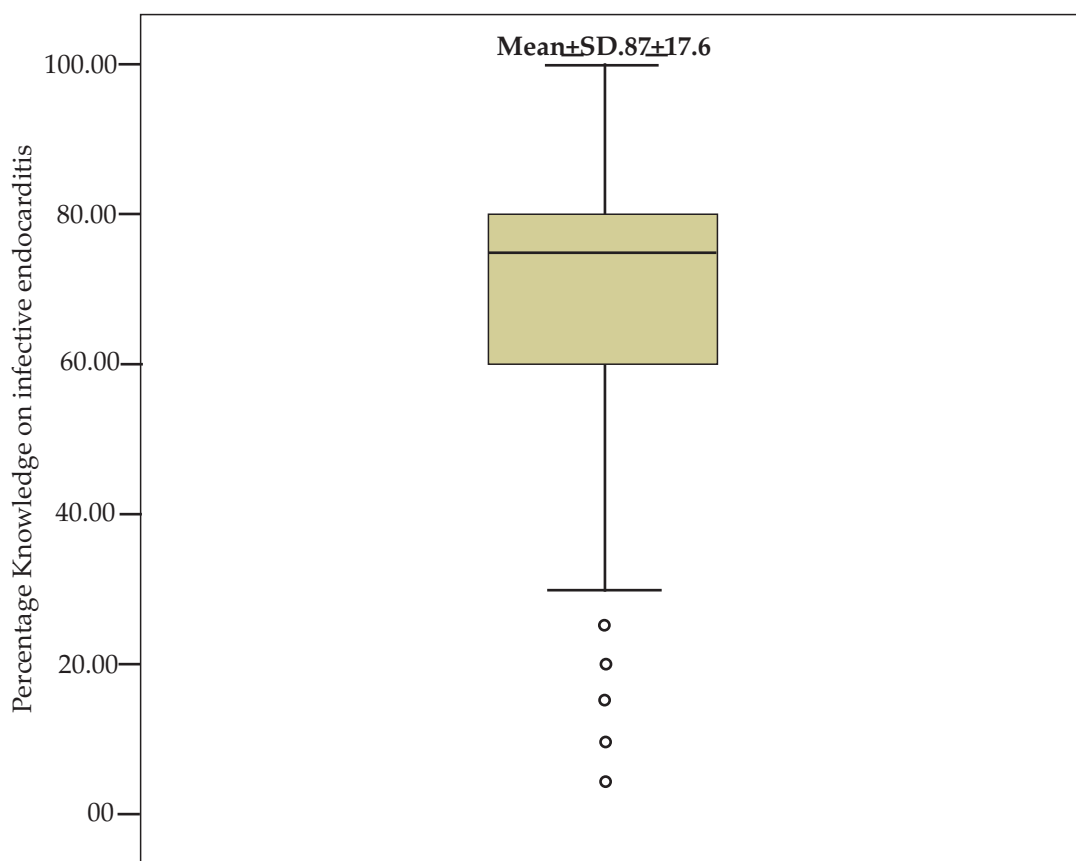
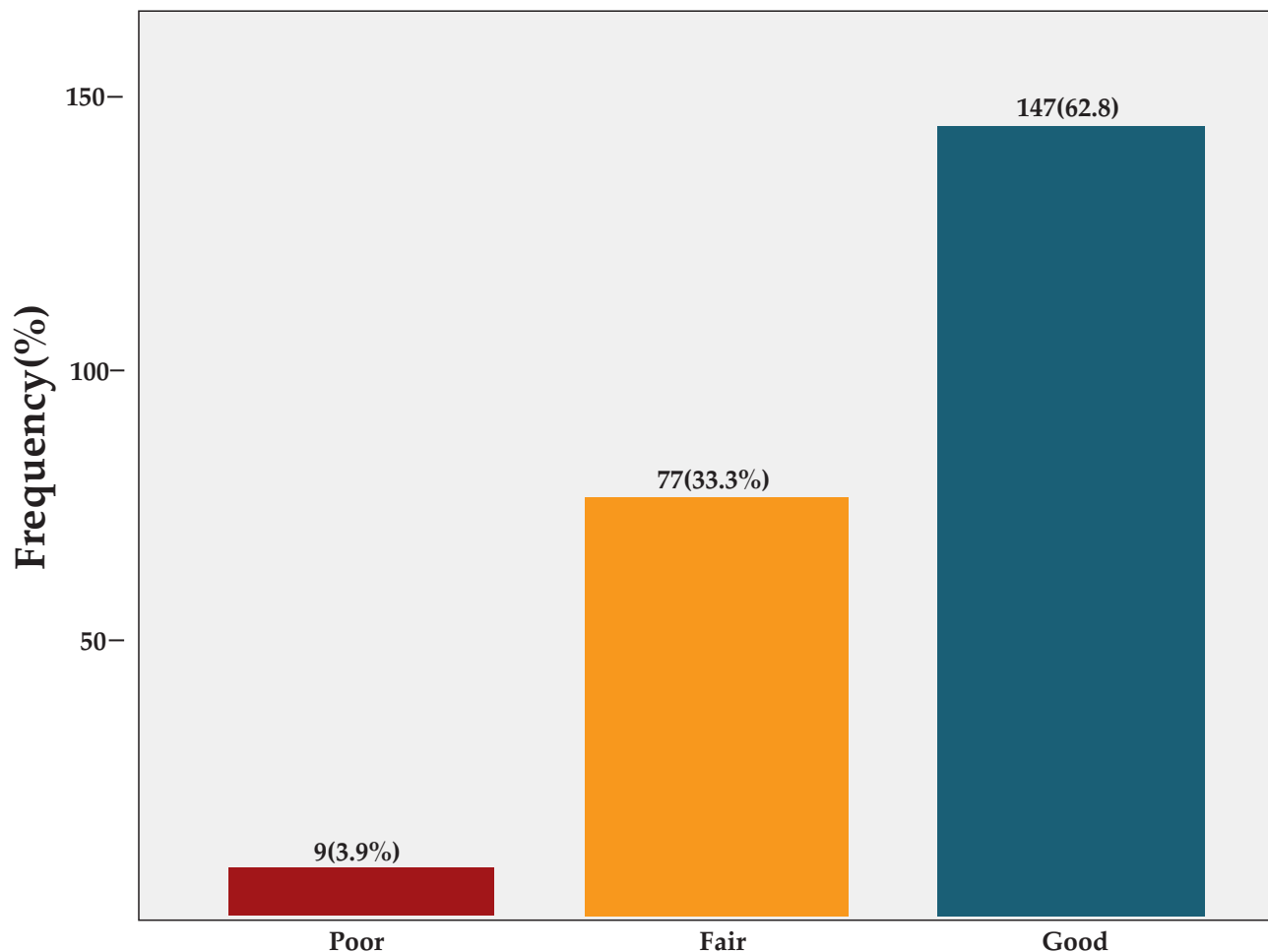**Figure 2: Overall knowledge of Dentists on infective endocarditis**

Table 2: Proportion with knowledge of infective endocarditis

	500L (n=61)	600L (n=113)	Interns (n=57)	Total (n=231)	p-value
Conditions requiring antibiotics to prevent infective endocarditis (Multiple response)					
Prosthetic heart valve or heart valve repair with prosthetic material	48(78.7)	106(93.8)	55(95.5)	209(90.5)	0.001*
History of endocarditis	50(82.0)	102(90.3)	52(91.2)	204(88.3)	0.195
Heart transplant with abnormal heart valve function	49(80.3)	98(86..7)	45(78.9)	192(83.1)	0.351
Cyanotic congenital heart disease	42(68.9)	73(64.6)	37(64.9)	152(65.8)	0.842
Cogenital heart defect that has been completely repaired with prosthetic material	47(77.0)	91(80.5)	48(84.2)	186(80.5)	0.618
Repaired congenital heart disease with residual effect	48(21.3)	79(69.9)	47(82.5)	174(75.3)	0.156

Table 3: Dental procedure that can lead to infective endocarditis (Multiple response)

|	500 L (n=61)	600 L (n=113)	Interns (n=57)	Total (n=231)	p-value
Daily activities like tooth brushing	41(67.2)	53(46.9)	23(40.4)	17(50.6)	**0.008***
Scaling and polishing	45(73.8)	78(69.0)	42(73.7)	165(71.4)	0.731
Biopsy	34(55.7)	45(39.8)	43(75.4)	122(52.8)	**<0.001***
Extraction	59(96.7)	107(95.5)	54(94.7)	220(95.7)	0.867
Initial placement for orthodontic bands	17(27.9)	70(61.9)	32(56.1)	119(51.5)	**<0.001***
Scaling and root planning	51(83.6)	98(86.7)	54(94.7)	203(87.9)	0.157
Powered election brush	24(39.3)	49(43.4)	17(29.8)	90(39.0)	0.232
Restoration of caries with amalgam	19(31.1)	72(63.7)	42(73.7)	133(57.6)	**<0.001***
RCT	43(70.5)	90(79.6)	44(77.2)	177(76.6)	0.393

Table 4: Proportion with knowledge of use of different antibiotics

Antibiotics	500 L (n=61)	600 L (n=113)	Interns (n=57)	Total (n=231)	p-value
Amoxicillin	42(68.9)	99(87.6)	46(80.7)	187(81.0)	0.011*
Frythromycin	31(50.8)	85(75.2)	36(63.2)	152(65.8)	0.005*
Clindamycin	20(32.8)	66(58.4)	29(50.9)	115(49.8)	0.005*
Cephalexin	23(37.7)	49(43.4)	22(38.6)	94(40.7)	0.718

Table 5: Knowledge of endocarditis in different centers

Centre	500 L	600 L	Interns	Overall
CMUL	55.0±22.7	85.0	72.4±14.9	64.63±13.7
LASUCOM	81.0±11.9	829±3.9	60.0	80.38±9.7
OAUTH	65.0	75.0±14.2	72.1±10.1	73.27±12.4
UBTH	NA	70.6±14.1	74.2±8.6	71.33±13.1
UNIPORT	66.67±18.9	69.6±19.3	78.0±12.5	70.61±18.2
UCH	71.1±21.8	77.6±15.8	86.7±5.8	74.89±17.1
UMTH	59.0±18.2	64.2±14.9	63.3±18.9	62.79±16.3
p-value	0.092	0.040*	0.206	0.002

CMUL-College of Medicine, University of Lagos
NA-Not available

Figure 3: Source of information about infective endocarditis (Multiple)
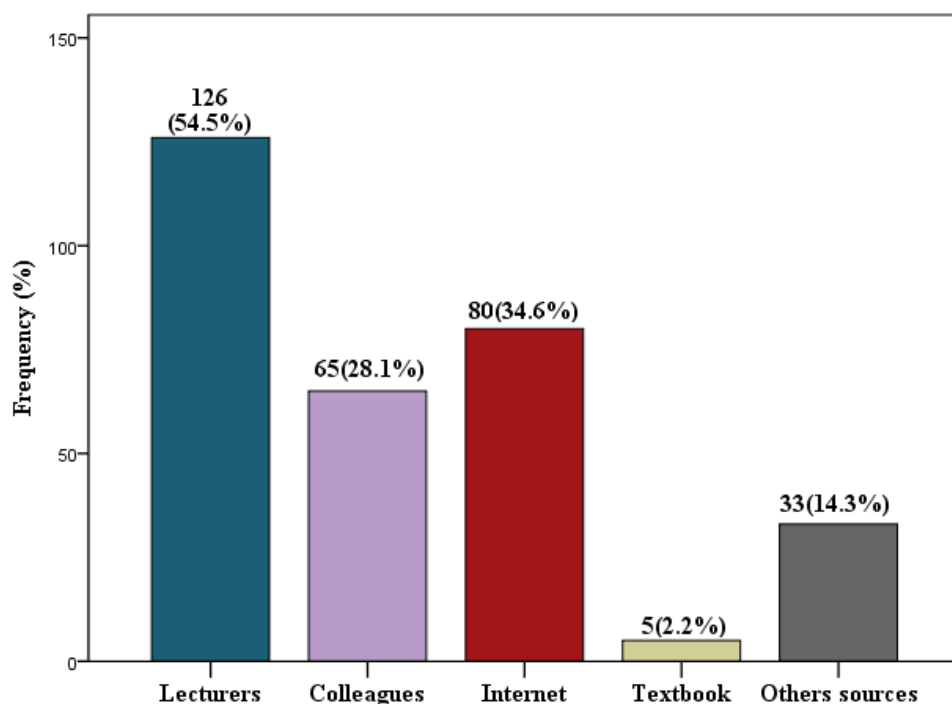
RESULTS: Two hundred and thirty one students participated in the study. There were 120 males and 111 females, in the ratio of 1.08: 1. The participants were mainly in the age range 22 to 25 years and the mean age was 25.34 ± 3.60years. From the box plot in Fig 1, the overall mean knowledge on infective endocarditis was 68.99 ± 1.76, with the upper limit at 80 and lower limit at 60. The median was at 70. From the questions asked, a student scored 0 and another 100.

Figure 2 showed that 147 (62.8%) had an acceptable/ good knowledge on IE.

From Table 2, Two hundred and nine (90.5%) participants knew that patients with prosthetic heart valve require prophylactic antibiotics prior to an invasive dental procedure to prevent IE. It was more amongst the 600L students and interns and this was significant. In cyanotic congenital heart disease that has not been fully repaired, only 152 (65.8%) recognised that the condition could lead to IE. There was no statistical difference amongst them.

From Table 3, the 500L students (67.2%) knew more than the 600L and the interns, that daily brushing can lead to infective endocarditis and this was also significant. The awareness that biopsy could lead to IE was expressed more by the interns (75.4%) than the 500L and 600L which was also significant. For the initial placement of orthodontic bands, many of the interns and 600L demonstrated that they were conversant with this information than the 500L students.

From Table 4, the awareness regarding the prescription of the right antibiotics (amoxicillin, azithromycin and clindamycin) was expressed more by the intern and the 600L across board. Most of them 94(40.7%) did not know that cephalexin could be used. Table 5 showed that Lagos State University College of Medicine students had the highest overall mean knowledge on infective endocarditis, followed by University College Hospital, Ibadan students and closely by Obafemi Awolowo University Teaching Hospital students, while the knowledge was least with College of Medicine, University of Lagos students.

Fig 3 showed that majority received the information from their lectures (54.5%).

DISCUSSION: Infective endocarditis is a critical lethal heart disease which accounted for about one case/1000 admission[16]. In a review of 10 articles, 0.16-5.4 cases were seen in 1000 patients[16]. It has been reported that increasing age due to age related degenerative valvular damage; increasing number of patients with prosthetic heart valves, and intravascular devices have increased the

occurrence of IE.[17,18] Also dental procedures inducing bacteremia have added to the increase.[119,20] Taking this into cognizance, AHA has been publishing recommendations for antibiotic prophylaxis and prevention of IE since 1955.[4] This guideline of late, revised and updated, has been accepted as the standard in many countries such as United State of America, Canada etc. but a country like Sweden, adopted the United Kingdom National Institute for Health and Care Excellence (UK NICE) guidelines.[21]

From this study, the participants were mainly in the age range of 22 to 25 years, with mean age of 25.34 ± 3.60years which is consistent with the level of education. The mean comparison of percentage score for age was not statistically significant (p= 0.062) but the knowledge on infective endocarditis and age was statistically significant (p= 0.035). This is in agreement with the study by Ahmadi- Motamayel et al[8]which also found astatistically significant difference between age and knowledge. He compared the knowledge of general dentists and dental students on the prevention of IE in Hamadan, Iran. There was a statistical significant relationship between education and the information on IE as shown by mean proportion (p=0.023), as well as between the level of education and the knowledge of IE (p=0.022). This was also similar to the study conducted by Ahmadi-Motamayel et al,[8] p<0.005. One hundred and forty seven (62.8%) of the participants had a fair knowledge of IE. This connoted the total number of students who got 14 out of 20 questions correctly. This was similar to the studies done by Santhosh-Kumah et al [4] and Solomon [9]in which 63% and 62% had fair/ acceptable knowledge respectively.

It is encouraging that more than 90% of the respondents especially among the 600L students and the interns knew that prosthetic heart valve without antibiotic prophylaxis can lead to infective endocarditis. This was similar to the study by Ryalat et al (87.4%),[22] Hashemipour et al (94.6%) [23] and Adeyemo et al (94.2%)[24], although their studies were amongst dentists only. This is followed by history of previous infective endocarditis (88.3%), which was also similar to the study by Ryalat et al (88.2%) [21=22]. More interns and the 600L students than the 500L knew this. This may be due to the fact that they have longer clinical exposures than the 500L students. In this study, more respondents (65.8%) than those in Bahammam's et al [25] study (42%) knew that patients with cyanotic congenital heart disease can have IE if

such are not given prophylaxis before treatment.

The revised AHA guideline, stated that daily activities like brushing of teeth can lead to IE. The knowledge was expressed mostly by the 500L students which was statistically significant. Probably the new guidelines was just newly introduced to them and the 600L and the interns might have the knowledge of the old guideline. The 2007- 2017 AHA guidelines stated that any procedure requiring manipulation of the gingival, periapical tissue or perforation of the oral mucosa, must be given prophylactic antibiotic. Therefore whenever biopsy is planned, the patients must be given prophylaxis as it involves manipulation of the tissue. There was a statistical significance difference in knowledge which was expressed more by the interns and the 500L students.

The knowledge that initial placement of orthodontics bands require antibiotics was better expressed by the 600L and then the interns. The percentage of respondents who expressed this was lower (51.5%) when compared to the study done by Ghaderi et al [26] (77.5%).Restoration of caries with amalgam does not require antibiotics according to the latest AHA guideline. The correct answer was chosen more by the 600L and the interns.

The students and interns expressed fair knowledge in the choice of antibiotics to use as prophylaxis, although there was a statistical significance difference in all groups, with the knowledge expressed more by the 600L students and the interns. Amoxicillin was chosen by 81%, while in the study by Fawzan et al[20=27], 70% chose amoxicillin, but knowing that cephalexin was an antibiotic of choice for IE was low and cuts across every level. None of the students knew the right dose and time of administration of the antibiotics which was unexpected. This could be due to lack of teaching. The percentage of the respondents who got the knowledge of IE from the lectures was lower (54.5%) than those in the study conducted by Bahammam et al (71.9%).[21=25]

CONCLUSION: Though most of the participants had fair knowledge about conditions that require prophylactic antibiotics and the type of drugs, however, no one knew the dose and the time of administration of those antibiotics. Indeed, there is the need for infective endocarditis to be taught at class level because it is a serious condition that

should be treated with the urgency that it requires. This condition is life threatening and must not be handled with levity; a head knowledge of the condition is not enough, the dose and the time of administration of the antimicrobial must be well understood. A review of the dental curriculum and continuous education are highly recommended so as to achieve 100% knowledge amongst the dental students and the dentists.

CONFLICTS OF INTEREST

The author declares that there are no conflicts of interest.

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