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Assessment of the Knowledge and Awareness Levels of Dentists Regarding Prophylaxis for Infective Endocarditis

Diş Hekimlerinin İnfektif Endokardit Profilaksisi Hakkında Bilgi ve Farkındalık Düzeylerinin Değerlendirilmesi

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ABSTRACT

Aim: *Infective endocarditis (IE) is a serious heart disease with high mortality and morbidity. Antibiotic prophylaxis is recommended for patients at risk of infective endocarditis before dental procedures. This Turkish online descriptive survey aimed to evaluate the knowledge and awareness levels of dentists and dental students regarding antibiotic prophylaxis for patients at risk of infective endocarditis.*
Method: *Data on participants' demographics and responses regarding dental treatments and heart diseases requiring prophylaxis as well as antibiotic dosage, duration, and administration time were collected between February 1 and June 30, 2016 in Turkey. For each correct answer one point was given. A score of >4 was considered successful.*
Results: *In total, 584 dentists and 199 dental students participated in the questionnaire survey. The rate of administration of antibiotic prophylaxis against infective endocarditis was found as 92.59%. Overall success rates of dental procedures requiring prophylaxis and knowledge regarding heart diseases were 90.3% and 72.6%, respectively. Knowledge levels regarding the use of antibiotic prophylaxis for heart diseases and antibiotic dosage and duration were greater in women, those with ≤5 years of professional experience, dentists, and those working at dental faculties (p<0.05). Dentists with ≤5 years of professional experience had greater levels of awareness about dental procedures requiring prophylaxis than those with >5 years of experience (p<0.001).*
Conclusion: *Given their poor knowledge of antibiotic prophylaxis against infective endocarditis, once again it has been revealed that dentists should receive in-service training to keep up with current practices.*

Keywords: *Infective endocarditis, dentist, antibiotic prophylaxis, knowledge*

ÖZ

Amaç: *İnfektif endokardit (İE), yüksek mortalite ve morbiditeye sahip ciddi bir kalp hastalığıdır. İE riski taşıyan hastalara dental girişim öncesinde antibiyotik profilaksisi önerilmektedir. Online uygulanan tanımlayıcı nitelikteki bu anket çalışmasının amacı, İE gelişme riski bulunan hastalara diş hekimlerin ve diş hekimliği öğrencilerinin antibiyotik profilaksisi uygulama konusundaki bilgi ve farkındalık düzeylerini değerlendirmektir.*
Yöntem: *Profilaksi gerektiren dental girişimler ve kalp hastalıkları, profilakside uygulanan antibiyotiklerin dozu, süresi ve uygulama zamanı ile ilgili sorulara verilen yanıtlar ile birlikte katılımcıların demografik bilgilerini içeren anket verileri 1 Şubat-30 Haziran 2016 tarihleri arasında toplanmıştır. Her doğru cevaba bir puan verilmiş ve dört puan üstü başarılı olarak kabul edilmiştir.*
Bulgular: *Toplamda 584 diş hekimi ve 199 diş hekimliği öğrencisi ankete katılmıştır. İE profilaksisi uygulama oranı %92,6 saptanmıştır. Profilaksi gerektiren dental prosedürler ve kalp hastalıkları ile ilişkili sorularda genel başarı oranı sırasıyla %90,3 ve %72,6 olarak bulunmuştur. Kadınların, beş ve beş yıldan daha az deneyimi olan diş hekimlerin ve diş hekimliği fakültelerinde çalışanların profilaksi gerektiren kalp hastalıkları, antibiyotik dozu ve uygulama süresi ile ilgili bilgi düzeyleri daha yüksek saptanmıştır (p<0,05). Beş ve beş yıldan daha az deneyimli diş hekimlerinin profilaksi gerektiren dental prosedür konusundaki farkındalık düzeyi beş yıldan fazla deneyim sahibi olanlara göre daha fazladır (p<0,001).*
Sonuç: *Diş hekimlerinin İE profilaksisi uygulama konusunda bilgi düzeylerinin düşük saptanması, diş hekimlerinin güncel gelişmeleri takip etmeleri için hizmet içi eğitimlerin gerekliliği bir kez daha ortaya koymuştur.*

Anahtar kelimeler: *İnfektif endokardit, diş hekimliği, antibiyotik profilaksisi, bilgi*

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INTRODUCTION

Infective endocarditis (IE) is a serious infection of the endocardial surface of the heart and its valves and is associated with high mortality and morbidity[1]. The most common causative agents for the development of IE include bacteria and fungi, and, more rarely, rickettsia, mycoplasma, and chlamydia. Bacterial endocarditis occurs more frequently in individuals with congenital heart disease, a prosthetic heart valve, and a history of IE.

The flora of the human mouth, which comprises >700 microorganisms, is significant for the development of bacteremia[2]. IE tends to develop secondary to bacteremia due to damage to or bleeding of the gingival tissue. In routine daily events, such as brushing the teeth, microorganisms are able to enter the blood circulation. A study by Lochart et al.[3] on 290 patients found a 23% increase in bacteremia within 5 min after brushing the teeth.

The efficacy of antibiotic prophylaxis administered to patients at risk of IE before dental procedures remains controversial[4]. Moreover, the unnecessary use of antibiotics may lead to the development of antibiotic resistance of microorganisms and anaphylactic reactions during dental procedures. According to the guidelines of the National Institute for Health and Clinical Excellence of the Department of Health of the United Kingdom, antibiotic prophylaxis is not recommended prior to dental procedures[5]. However, the guidelines of the American College of Cardiology and the European Society of Cardiology recommend antibiotic prophylaxis before several dental procedures for patients at a high risk of IE[6,7].

The present study aimed to assess the awareness levels of dentists and dental students regarding the use of prophylaxis to prevent IE in patients with heart disease undergoing dental procedures, as well as antibiotic choice, dosage, and administration time. We also assessed whether a request for medical consultation from patients with a history of heart disease was effective on IE prophylaxis.

MATERIAL and METHODS

This descriptive survey was conducted with dentists and dental students between February 1 and June 30, 2016 via an online system in Turkey. The questionnaires were sent via e-mail to the participants who were requested to respond the items online. A total of 783 individuals completed the questionnaire. The study protocol was approved by the local Ethics Committee (SB Istanbul Medeniyet University Goztepe Training and Research Hospital Ethics Committee for Clinical Investigations, Klinik Araştirmalar Etik Kurulu; number 2016/0008 on 12.01.2016). Each author involved in the study was required to recruit at least 20 dentists or dental students to participate in a questionnaire survey. All participants provided informed consent. All study procedures were performed in accordance with the ethical standards of the respective committees on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

The questionnaire was designed in accordance with the guidelines published by the European Society of Cardiology for the diagnosis, prevention, and treatment of IE6. The participants were asked 17 questions in 4 different sections.

The first section comprised items regarding the characteristics of the study participants (age, gender,the institution worked for, duration of professional experience, field of expertise, and requests for medical consultation before antibiotic prophylaxis). The second section comprised questions regarding dental procedures and the use of prophylaxis. The third section included questions regarding the knowledge of cardiac conditions requiring antibiotic prophylaxis. The fourth section assessed antibiotic dosage, duration, and administration time. Participants who did not administer antibiotic prophylaxis against IE completed only the first section of the questionnaire.

In the second section of the questionnaire, dental procedures requiring prophylaxis that were expected to be known were questioned. The administra-

tion of antibiotic prophylaxis was accepted as the correct answer before tooth extraction, root canal treatment, and gingival tissue and periapical region manipulation, as well as any other procedure likely to cause perforation of the oral mucosa. The use of antibiotic prophylaxis during removal of sutures, placement of removable prosthodontic instruments, and orthodontic appliances, correction with braces, and before dental X-rays was considered to be incorrect.

In the third section of the questionnaire, heart diseases requiring prophylaxis that were expected to be known were inquired. Advice on antibiotic prophylaxis for patients with a prosthetic valve, history of IE, an unrepaired cyanotic congenital heart disease, and post-cardiac transplantation valvulopathy was accepted as the correct answer. The administration of antibiotic prophylaxis for patients with valvular heart diseases associated with rheumatic fever, mitral valve prolapse, coronary artery disease, and any chronic heart disease was evaluated as the wrong answers.

The fourth section of the questionnaire was designed to determine the extent of knowledge regarding the choice of an antimicrobial agent, dosage, and administration time. The use of 2 g of oral single-dose amoxicillin 30-60 min before a procedure was considered to be the correct answer. Each correct response was graded with one point, and the score of each section was assessed separately. The participants who obtained a score of >4 in the second and third sections and those who gave correct answers to all questions in the last section were regarded as successful.

Data analysis was performed using SPSS Statistics for Windows, version 17.0 (SPSS, Inc., Chicago, IL, USA). Data were expressed as the mean and standard deviation or frequency and percentage. Categorical variables were compared using the chi-square or Fisher's exact test. The scores of the 3 sections were compared according to the participants' gender, duration of professional experience, professional status (dentists, dental students, or dental specialists), and working environment (whether or not they worked at a dental school). The Mann-Whitney U test was used to compare data that were not normally distributed. A probability (p) value of <0.05 was considered statistically significant.

RESULTS

In total, 584 dentists and 199 dental students (3, grade and above), comprising 446 women (57.0%) and 337 men (43.0%) with a mean age of 33.5±10.3 (range, 20-72) years, responded to the questionnaire. The sociodemographic characteristics of the study participants are summarized in Table 1.

Table 1. Sociodemographic characteristics.

	Number (n)	Percent (%)
Gender		
Women	446	57.0
Men	337	47.0
Age (years)		
20–29	158	27.1
30–39	199	34.1
40–49	165	28.25
50–59	52	9.9
>60	10	1.7
Dental Student		
Yes	199	25.4
No	584	74.6
Dental Specialist		
Yes	240	41.1
No	344	58.9
Duration of professional experience (year)*		
1-5	165	28.25
6-10	91	15.6
11-15	107	18.3
>15	221	37.8
Institution of work		
Faculty of Dentistry	365	46.6
Oral and Dental Health Private	171	21.8
Center	247	31.5
Prophylaxis against IE		
Administering	725	92.6
Not administering	58	7.4

**Except for dental students*

The rate of correctly answered questions regarding underlying heart disease before any dental procedure was 98.9% (n=774), whereas that of administration of antibiotic prophylaxis against IE was 92.6% (n=725). Fourteen (19.5%) dentists who prescribed

Table 2. Distribution of responses to questions regarding dental procedures and cardiac conditions requiring prophylaxis.

		The rate of responders giving a correct answer n (%)			
	Correct Answer	Dental Student (n=187)	Dentist (n=538)	Total (n=725)	P value
Dental Procedure					
Tooth extraction	Yes	185 (98.9)	527 (98.0)	712 (98.2)	0.585
Root canal treatment	Yes	137 (73.3)	323 (60.0)	460 (63.5)	<0.001***
Perforation of the oral mucosa	Yes	132 (70.6)	433 (80.5)	565 (77.9)	<0.01**
Suture removal	No	172 (92.0)	488 (90.7)	660 (91.0)	0.600
Taking dental radiographs	No	185 (98.9)	536 (99.6)	721 (99.4)	0.275
Placement or adjustment of removable prosthodontic or orthodontic appliances or orthodontic brackets	No	147 (78.6)	475 (88.3)	622 (85.8)	<0.001***
Dental procedures that involve manipulation of gingival tissue and the periapical region of teeth	Yes	144 (77.0)	471 (87.55)	615 (84.8)	<0.001***
Heart Disease					
Presence of prosthetic valve	Yes	114 (61.0)	475 (88.3)	589 (81.2)	<0.001***
History of IE	Yes	144 (77.0)	500 (92.9)	644 (88.8)	<0.001***
Unrepaired cyanotic congenital heart disease	Yes	99 (52.9)	323 (60.0)	422 (58.2)	0.090
Valvular heart disease associated with rheumatic fever	No	71 (38.0)	64 (11.9)	135 (18.6)	<0.001***
Mitral valve prolapse	No	115 (61.5)	282 (52.4)	397 (54.8)	<0.05*
Coronary artery disease	No	152 (81.3)	412 (76.6)	564 (77.8)	0.183
Post-cardiac transplantation valvulopathy	Yes	83 (44.4)	368 (68.4)	451 (62.2)	<0.001***
Patients who reported any heart disease	No	127 (67.9)	411 (76.4)	538 (74.2)	<0.05*

**Significant, **Highly significant, ***Very highly significant*

Table 3. Distribution of responses to questions regarding antibiotic prophylaxis regimens against infective endocarditis.

The use of antibiotic prophylaxis*	Correct answer	The rate of responders giving a correct answer (N=725), n (%)
30–60 min before the procedure	Yes	639 (88.1)
Amoxicillin 2 g, oral	Yes	463 (64.0)
Use of a single dose	Yes	451 (62.2)

**Individuals without allergy or without problems with oral intake*

Table 4. Evaluation of success according to consultation requests.

	Successful (n/%)	Unsuccessful (n/%)	Successful (n/%)	Unsuccessful (n/%)	P value
Dental Procedures	575 (98.5)	9 (1.5)	138 (97.9)	3 (2.1)	0.624
Cardiac Conditions	526 (90.0)	58 (9.9)	113 (80.1)	28 (19.9)	<0.001***
Antibiotic Regimens	264 (45.2)	320 (54.8)	46 (32.6)	95 (67.4)	<0.01**

**Significant, **Highly significant, ***Very highly significant*

antibiotics, (n=141) benefited from their own experiences, whereas the others requested consultations, mostly from cardiologists. The distributions of the responses to the questions on dental procedures and cardiac conditions requiring prophylaxis are shown in Table 2. Of the 725 participants, 655 (90.3%) responded successfully to the questions related to dental procedures and 526 (72.6%) to those related to heart diseases. The distributions of the responses to the questions regarding antibiotic choice, dose and administration time are shown in Table 3. Of the 725 participants, 310 (42.8%) responded successfully to the questions in the last section. When evaluating the success rate according to consultation requests, it was determined that those who requested consultations were more successful in giving accurate answers related to cardiac conditions requiring prophylaxis and antibiotic choice, dose, and administranswers ation time. However, there was no difference in success in the section related to dental procedures (Table 4).

Table 5. Comparison of the knowledge levels of the participants regarding the administration of infective endocarditis prophylaxis.

	Dental procedures that require antibiotic prophylaxis (S:7)		Cardiac conditions that require antibiotic prophylaxis (S:8)		Antibiotic to be used as prophylaxis, its dose, and duration (S:3)	
Characteristic (Number)	**Average score±SD**	**p value**	**Average score±SD**	**p value**	**Average score±SD**	**P value**
Gender						
Women (416)	5.97±1.05	0.328	5.27±1.18	<0.01**	2.24±0.85	<0.001***
Men (309)	6.05±0.99		5.00±1.18		2.01±0.95	
Professional experience						
≤5 years (148)	6.29±0.81	<0.001***	5.66±1.01	<0.001***	2.48±0.79	<0.001***
>5 years (390)	5.95±1.05		5.12±1.12		2.08±0.91	
Dental student						
Yes (187)	5.89±1.08	0.106	4.84±1.32	<0.001***	1.99±0.90	<0.01**
No (538)	6.04±1.00		5.27±1.12		2.19±0.89	
Dental specialist						
Yes (219)	6.04±1.07	0.610	5.42±1.13	<0.01**	2.47±0.79	<0.001***
No (319)	6.04±0.95		5.16±1.10		2.00±0.91	
Working at						
Dental facility (341)	5.99±1.06	0.955	5.14±1.27	0.913	2.26±0.83	<0.001***
Other areas (384)	6.02±0.99		5.17±1.11		2.03±0.94	

S: full score
** Significant, **Highly significant, ***Very highly significant*

The average scores obtained from the 3 different sections are shown in Table 5. Comparisons of knowledge levels regarding the use of prophylaxis based on gender, professional experience, professional status, and working environment showed that women, those with ≤5 years of professional experience, dentists, and those working at dental facilities have higher knowledge levels regarding heart diseases requiring prophylaxis, choice of antimicrobial agents, duration of prophylaxis, and dosage regimen than men, those with >5 years of professional experience, dental students, and those who did not work at a dental facility ($p<0.05$). When the awareness level of dental treatment (regarding whether prophylactic antibiotics are needed or not) was compared, those with ≤5 years of professional experience had better knowledge than those with >5 years of professional experience ($p<0.001$).

DISCUSSION

IE is a life-threatening cardiac condition with a poor prognosis. Bacteremia caused by any dental procedure may result in bacterial IE. In dentistry, tooth extraction is the main cause of bacteremia[8]. The aim of antibiotic prophylaxis is to minimize the risk of IE by preventing the occurrence of bacteremia. In 2000, the Turkish Society of Cardiology published guidelines on the prevention of IE based on the recommendations of the American Heart Association (AHA)[9]. No current local guide exists. The publications or reviews by dental professionals in Turkey give more weight on recommendations by AHA guideline[10]. It is of paramount importance to obtain a thorough medical history from a patient and perform a detailed dental examination before prescribing antibiotics as prophylaxis before dental treatment. In the present study, of the 783 participants, 774 (98.85%) had asked their patients about cardiac conditions while taking their history before a dental procedure and 725 (92.6%) participants had prescribed antibiotics.

We also found that 584 (80.55%) participants sought medical consultation before administering antibiotics, and 12.3% of them sought consultation from infectious disease specialists and the remaining from cardiologists. Hatipoğlu et al.[11] evaluated the accuracy of medical consultations for 121 patients before periodontal treatment and found that most consultations were obtained from internal disease specialists

and cardiologists, whereas no consultation was obtained from the Department of Infectious Diseases. The same study found that the rate of appropriate antibiotic prophylaxis recommended by cardiologists according to the AHA guidelines was 9.5%. In addition, a survey conducted in Brazil showed that only 33% of 21 dentists adhered to the AHA guidelines on the administration of antibiotic prophylaxis[12]. Our study has shown that medical consultation for patients with heart disease before dental intervention increases success in prophylaxis against IE. We think that cardiologists or infectious disease specialists follow the guidelines on IE more closely.

The second section of the questionnaire assessed dental interventions requiring prophylaxis. While antibiotic prophylaxis is recommended prior to tooth extraction, root canal treatment, and gingival tissue and periapical region manipulation, as well as conditions likely to cause perforation of the oral mucosa, it is not recommended before any other dental procedures. The overall success rate in this section was 90.3% (655/725). In the present study, antibiotic prophylaxis was prescribed most often prior to tooth extraction and least often prior to root canal treatment.

In a survey of dental students and interns, 84% of the participants answered correctly to the question, "Before what dental procedure do you use antibiotic prophylaxis?" However, the correct response rate for antibiotic administration for root canal treatment was comparatively poor[13]. A study by Ryalat et al.[14] found that the rate of antibiotic prophylaxis use before tooth extraction was 94.5% and that before pre-periodontal surgery was 88.2%. In the present study, there were no statistically significant differences with regard to gender, professional status (dental specialist vs. dental student), and working at a dental facility, suggesting that many dentists are aware of the risk of bacteremia after any dental procedure causing bleeding.

The third section of the questionnaire inquired about cardiac conditions requiring prophylaxis. The administration of antibiotic prophylaxis before a dental procedure is recommended for patients with a prosthetic valve, a history of IE, an unrepaired cyanotic congenital heart disease, and post-cardiac transplantation valvulopathy. The overall success rate of this section was 72.6% (526/725), which was rather low. The most likely reason for this low rate was that continuous antibiotic prophylaxis to patients with a valvular heart disease is associated with an increased risk of rheumatic fever and mitral valve prolapse. Similar findings have been reported in the literature. A study conducted in Israel investigating the adherence of 118 dentists to the recommendations of the 2007 AHA guidelines found that only 81.3% of dentists inquired about the status of cardiac conditions. Of the participants, 57.6% recommended prophylaxis for patients with mitral valve prolapse, which was probably based on the guidelines prior to 2000 for such individuals[15]. A survey of Iranian dentists conducted by Hashemipour et al.[16] showed that the most frequent justifications for the administration of antibiotic prophylaxis for cardiac conditions were, in descending order, a history of IE, rheumatic fever-associated cardiac diseases, and mitral valve prolapse. Another 2010 survey conducted in Iran indicated that antibiotic prophylaxis was, in descending order, given to those with a history of IE, a prosthetic valve, and rheumatic fever-associated cardiac diseases[13]. Because all the available guidelines are from developed countries where rheumatic fever-associated heart valve diseases have been nearly eliminated, recommendations contraindicating the use of prophylaxis for such diseases should be re-evaluated in consideration of the high rate of heart valve disease in other countries, including Turkey.

The fourth section of the questionnaire assessed the awareness levels regarding the choice of antimicrobial agents, administration time, and dosage. The overall success rate was 42.8% (310/725). For individuals without allergy or oral intake problems, 2 g of amoxicillin is recommended 30-60 min before a dental intervention[6]. Although 88.1% of the participants were aware of the administration times, knowledge levels regarding the choice and dosage of an antibi-

otic were poor. This lack of knowledge may result in the misconception that the long-term use of antibiotics minimizes the risk of infection and may neglect the possibility of antibiotic resistance or side effects. A study conducted in Iran found that 51% of dentists and 37% of dental students reported that antibiotic treatment should be continued after dental procedures[13]. A study by Bahammam et al.[17] reported that 63.5% of dental students and interns considered amoxicillin at a dosage of 2 g as the first choice for antibiotic prophylaxis. In another study, more than half of the dentists (68.3%) reported that amoxicillin is the most frequently prescribed antibiotic[16].

We found that women, dentistry specialists, dental care practitioners working at a dentistry school, those who were not dental students, and those with <5 years of professional experience were most likely to correctly identify underlying cardiac diseases and appropriate antibiotic regimens. Motamayel et al.[13] reported that dental students have greater knowledge regarding the administration of antibiotic prophylaxis to prevent the development of IE than dentists. The same study found no difference between men and women in the knowledge level regarding the use of antibiotic prophylaxis concerning dental procedures. Kumar and Sneha reported that 73% of dental students are aware of IE prophylaxis and prefer amoxicillin as their first choice[18]. However, older professionals and those with more experience and earlier graduation had lower knowledge levels[13]. Moreover, a survey of 150 dentists by Eskandari et al.[19] showed that older dentists with more professional experience have lower knowledge levels regarding the administration of antibiotic prophylaxis prior to dental procedures for patients with heart diseases. In the same study, the rates of awareness levels regarding heart diseases requiring prophylaxis, necessary dental procedures, and appropriate antibiotic administration were 63.7%, 66.8%, and 47.7%, respectively[19].

Eskandari et al.[19] found no difference in the knowledge level regarding the use of antibiotic prophylaxis between men and women, whereas Ghaderi et al.[20] reported that male dentists are more knowledgeable than female dentists. Although we detected no statistically significant difference between the genders in determining the methods for dental procedures, women had more knowledge about heart disease and antibiotic administration. A study by Lauber et al.[21] showed that those with >20 years of experience have lower knowledge regarding use of antibiotic prophylaxis before dental procedures.

In short, the results of the present study show that the knowledge level of dentists and dental students is at the highest level regarding dental procedures requiring antibiotic prophylaxis and at the lowest level regarding appropriate antibiotic choice and dosage. However, the rate of success in determining the underlying cardiac diseases seems to be moderate. The fact that prophylaxis is still administered to patients with heart diseases associated with rheumatic fever in Turkey suggests that dentists do not comply with the current guidelines. For antibiotic prophylaxis to be effective, it is important that the appropriate antibiotic is given at the correct dosage and time. The unnecessary use of antibiotics could lead to the emergence of resistant bacteria, which has already reached alarming levels in Turkey. We think that the misuse of antibiotics in Turkey is problematic in every medical field. Therefore, we believe that the use of antibiotics should be limited in order to reduce resistance as much as possible.

CONCLUSION

Due to rapid developments in the fields of medicine and dentistry, continuous medical education should be provided to practitioners. Our findings show that dentists with >5 years of professional experience have significantly lower knowledge levels regarding indications of prophylaxisand practices than those with <5 years of professional experience. This is an indication of the inadequacy of continuous medical education. Therefore, it is necessary and important for in-service training to be conducted by professional associations. At the same time, the knowledge level of dental students was also found to be low in this respect. Hence, further education is needed re-

garding the application of antibiotic prophylaxis for the prevention of IE for students in the Faculty of Dentistry when the course of cardiovascular system diseases is explained.

REFERENCES

1. Fowler VG, Scheld WM, AS B. Endocarditis and Intravacular Infections. In: Principles and Practice of Infectious Diseases. 2010; 1067-1112.
2. Paster BJ, Olsen I, Aas JA, Dewhirst FE. The breadth of bacterial diversity in the human periodontal pocket and other oral sites. Periodontol 2000. 2006;42(1):80-7. https://doi.org/10.1111/j.1600-0757.2006.00174.x
3. Lockhart PB, Brennan MT, Sasser HC, Fox PC, Paster BJ, Bahrani-Mougeot FK. Bacteremia associated with toothbrushing and dental extraction. Circulation. 2008;117(24):3118-25. https://doi.org/10.1161/CIRCULATIONAHA.107.758524
4. Owen CP, Huang WH. Antibiotic prophylaxis for dental procedures: is it necessary? SADJ. 2012;67(7):413-9. https://doi.org/10.18773/austprescr.2017.054
5. NICE. Prophylaxis against infective endocarditis: antimicrobial prophylaxis against infective endocarditis in adults and children undergoing interventional procedures. NICE Clin Guid 64. 2008;(April 2007). http://www.ncbi.nlm.nih.gov/pubmed/21656971.
6. Habib G, Lancellotti P, Antunes MJ, et al. 2015 ESC Guidelines for the management of infective endocarditis. Eur Heart J. 2015;36(44):3075-3128. https://doi.org/10.1093/eurheartj/ehv319
7. Wilson W, Taubert KA, Gewitz M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. Circulation. 2007;116(15):1736-54. https://doi.org/10.1161/CIRCULATIONAHA.106.183095
8. Olsen I. Update on bacteraemia related to dental procedures. Transfus Apher Sci. 2008;39(2):173-8. https://doi.org/10.1016/j.transci.2008.06.008
9. Türk Kardiyoloji Derneği. İnfektif Endokarditten Korunma Kılavuzu. https://www.tkd.org.tr/kilavuz/k04.htm. Published 2000. Accessed September 6, 2018.
10. Yalçın-Yeler D, Nihat Ç, Hasan Y. Infective endocarditis and prophylaxis requirement in dentistry. Cumhur Dent J. 2011;14(2):133-9. http://dergipark.gov.tr/download/article-file/48234. Accessed September 6, 2018.
11. Hatipoğlu H, Demiralp B. The Evaluation of Medically Compromised Periodontal Patients and the Analysis of Consultation Forms. Clin Dent Res. 2005;29(3):65-75. http://www.dishekdergi.hacettepe.edu.tr/htdergi/makaleler/2005sayi3makale-11.pdf. Accessed September 6, 2018.
12. Maia LC, Coutinho AC, Castro GF. Knowledge and practices of dentists in preventing infective endocarditis in children. Spec Care Dent. 2009;29(4):175-8. https://doi.org/10.1111/j.1754-4505.2009.00087.x
13. Ahmadi-Motamayel F, Vaziri S, Roshanaei G. Knowledge of General Dentists and Senior Dental Students in Iran about Prevention of Infective Endocarditis. Chonnam Med J. 2012;48(1):15-20. https://doi.org/10.4068/cmj.2012.48.1.15
14. Ryalat S, Hassona Y, Al-Shayyab M, Abo-Ghosh M, Sawair F. Dentists' knowledge and practice regarding prevention of infective endocarditis. Eur J Dent. 2016;10(4):480-5. https://doi.org/10.4103/1305-7456.195158
15. Zadik Y, Findler M, Livne S, Levin L, Elad S. Dentists' knowledge and implementation of the 2007 American Heart Association guidelines for prevention of infective endocarditis. Oral Surgery, Oral Med Oral Pathol Oral Radiol Endodontology. 2008;106(6):16-9. https://doi.org/10.1016/j.tripleo.2008.08.009
16. Hashemipour M, Baharlooei K, Mohammadi A. Iranian dentits' knowledge of antibiotic prophylaxis guidelines for prevention of bacterial endocarditis. Shiraz Univ Den J. 2007;8:46-57.
17. Bahammam MA, Abdelaziz NM. Awareness of Antimicrobial Prophylaxis for Infective Endocarditis Among Dental Students and Interns at a Teaching Hospital in Jeddah, Saudi Arabia. Open Dent J. 2015;9:176-80. https://doi.org/10.2174/1874210601509010176
18. Kumar S, Snena S. Knowledge and awareness regarding antibiotic prophylaxis for infective endocarditis among undergraduate dental students. Asian J Pharm Clin Res. 2016;9:154-9. https://doi.org/10.22159/ajpcr.2016.v9s2.13405
19. Eskandari A, Abolfazli N, Lafzi A. Endocarditis Prophylaxis in Cardiac Patients: Knowledge among General Dental Practitioners in Tabriz. J Dent Res Dent Clin Dent Prospects. 2008;2:15-9. https://doi.org/10.5681/joddd.2008.003
20. Ghaderi F, Oshagh M, Dehghani R, Hasanshahi R. Awareness of Iranian's General Dentists Regarding the Latest Prophylaxis Guideline for Prevention of Infective Endocarditis. J Dent (Shiraz, Iran). 2013;14(1):6-12. http://www.ncbi.nlm.nih.gov/pubmed/24724110. Accessed September 6, 2018.
21. Lauber C, Lalh SS, Grace M, et al. Antibiotic prophylaxis practices in dentistry: A survey of dentists and physicians. J Can Dent Assoc (Tor). 2007:263-269.