



Endocarditis prophylaxis in dental practice: Evaluation of knowledge among dental students, pediatric dentistry residents, and specialists in pediatric dentistry

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ABSTRACT

Objective: We aimed to determine the degree of knowledge about endocarditis prophylaxis (EP) among dental students, pediatric dentistry residents, and specialists in pediatric dentistry, and to identify the areas of knowledge that require attention. **Material and methods:** This is a cross-sectional research including 155 participants divided into three study groups. Respondents completed a questionnaire to evaluate their knowledge on EP consisting of three domains: dental procedures, dose/medication, and heart condition. Data were examined through analysis of variance (ANOVA) using generalized linear models. **Results:** We stratified EP knowledge into three areas: dental procedures (no differences), dose/medication (statistically significant difference between group 2 and 3 [84.62% vs. 38.89%, $p=0.044$]) and heart condition (no differences but low degree of knowledge [35.48%, 53.85%, and 44.44%]). **Conclusions:** The three groups had inadequate knowledge of dental procedures. Pediatric dentistry residents showed a greater knowledge in the dose/medication area. Finally, the three groups require more attention and reinforcement in the heart condition area. It is thus necessary to reinforce EP knowledge in undergraduate and postgraduate programs and to encourage pediatric dentists to keep up-to-date in this issue.

Keywords: Antibiotic prophylaxis, endocarditis, knowledge, dental care.

INTRODUCTION

Since 1955, the American Heart Association (AHA) has regularly examined and revised its guidelines for the prevention of infective endocarditis (IE). The most recent guidelines were published in 2007.^{1,2}

IE is an uncommon but potentially fatal infection of the heart valve or endocardium and is often associated with congenital or acquired heart defects.³ Despite advances in diagnosis, antimicrobial therapy, surgical techniques, and management of complications, patients with IE still experience high morbidity and mortality linked to this condition.^{1,3}

Predisposing factors for the development of IE have changed over the last 50 years. Some reports in the literature refer to IE cases due to bacteremia preceded by a medical intervention, most frequently

a dental one.⁴ In general these cases are episodic, self-restrictive, and are not associated with any other systemic complication. Factors involved in their development are difficult to define, but a sensitive surface, such as a damaged endocardium, and a high bacterial load in the blood appear to be decisive. The microorganisms responsible in 90% of cases are *Staphylococcus*, *Streptococcus* and *Enterococcus*. Oral *Streptococcus* belongs to the group of *viridans* (*Streptococcus mutans* and *Streptococcus sanguis*). As part of the dental plaque, it may enter the bloodstream and cause bacteremia through everyday habits such as chewing or toothbrushing. Dental extraction and other dental procedures can also produce bacteremia.⁵

Repeated attacks of endocarditis reduce the 5-year survival rate of patients to 60%;⁶ treatment is often difficult and prognosis is poor. An understanding of the different prophylactic measures is thus of paramount importance in the prevention of this disease.⁶ Subacute endocarditis is the most common one; it appears after dental procedures in susceptible patients,⁶ whose oral cavity hosts numerous microorganisms that may access the bloodstream through a tissue injury.^{7,8}

Patients with heart disease have increased their survival rate,^{9,10} so there is a greater possibility that professionals in the area of oral health are involved in dental procedures of these patients.⁶ Dental treatments such as oral surgery, periodontal manipulations, and root canal treatments can produce infections of sterile

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vegetations in the heart valves of patients susceptible to endocarditis.^{7,11}

Different dental procedures and use of prophylactic antibiotics to prevent IE have been associated with a wide variation in the frequency, duration and magnitude of bacteremia.^{1,12} For this reason, many published studies have focused on the prevention or reduction of the magnitude and/or duration of bacteremia.¹³

Amoxicillin has had a significant impact on reducing the incidence, nature, and duration of bacteremia caused by dental procedures, but it does not eliminate bacteremia.¹³

Approximately one-third of all antibiotics used in medicine are prescribed for prophylactic purposes. In dentistry, however, prophylactic antibiotics are prescribed to avoid complications or to prevent

infections after surgical treatment. The consequences of endocarditis prophylaxis (EP) regarding allergic reactions, toxicity, side effects, and antibiotic resistance problems should thus be reviewed.¹⁴

Other studies have reported on how dentists generally administer antibiotic prophylaxis. Within medical care and oral health there are large variations in the decision of physicians to provide EP.¹⁵

The European Society of Cardiology (ESC) recommends using EP only for patients at high risk of IE^{5,12} and in dental procedures involving manipulation of the periapical region or gingival tissue or perforation of the oral mucosa.^{1,5} On the other hand, although some dental procedures and specific heart problems are recognized as an indication for EP in IE prevention,

Table 1: Modified from guidelines for endocarditis prophylaxis.^{1,4,12}

Cardiac conditions

Cardiac conditions associated with the highest risk of adverse outcome from endocarditis for which prophylaxis with dental procedures is reasonable

Prosthetic cardiac valve or prosthetic material used for cardiac valve repair

Previous IE

Congenital heart disease (CHD)*

Unrepaired cyanotic CHD, including palliative shunts and conduits

Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first 6 months after the procedure[†]

Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)

Cardiac transplantation recipients who develop cardiac valvulopathy

* Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of CHD.

† Prophylaxis is reasonable because endothelialization of prosthetic material occurs within 6 months after the procedure.

Dental conditions

All dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa*

* The following procedures and events do not need prophylaxis: routine anesthetic injections through noninfected tissue, taking dental radiographs, placement of removable prosthodontic or orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, shedding of deciduous teeth, and bleeding from trauma to the lips or oral mucosa.

Regimens for a dental procedure

Situation	Agent	Regimen: single dose 30 to 60 min before procedure	
		Adults	Children
Oral Unable to take oral medication	Amoxicillin	2 g	50 mg/kg
	Ampicillin or cefazolin or ceftriaxone	2 g IM or IV 1 g IM or IV	50 mg/kg IM or IV 50 mg/kg IM or IV
	Clindamycin or Azithromycin or Clarithromycin	2 mg 600 mg 500 mg	50 mg/kg 20 mg/kg 15 mg/kg
Allergic to penicillins or ampicillin-oral cephalixin* [‡]			
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone [†] or Clindamycin	1 g IM or IV 600 mg IM or IV	50 mg/kg IM or IV 20 mg/kg IM or IV

IM = indicates intramuscular; IV = intravenous.

* Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosage.

‡ Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin.

Table 2: Demographic characteristics of the study groups.

Characteristics	n (%)	Senior dental students n (%)	Pediatric dentistry residents n (%)	Specialists in pediatric dentistry n (%)
Female	99 (63.8)	75 (60.48)	12 (92.30)	12 (66.66)
Male	56 (31.6)	49 (39.51)	1 (7.70)	6 (33.33)
Age (years)	28.70*	23.83*	25.23*	37.05*
Graduation years	—	—	—	9.7* ± 6.26‡

* Mean.

‡ Standard deviation.

there is some controversy over other dental treatments as to whether or not they require prophylaxis.¹¹

Even though expert groups such as the AHA periodically issue specifications on antibiotic regimens and use indications, many oral health professionals are confused about the indication or type of antibiotic prophylaxis, and often base their decision on recommendations from prudent practitioners who rely on their own individual experiences and suggest prophylaxis in unpromising situations (*Table 1*).⁶

The aim of this study was to determine the degree of knowledge about EP in senior dental students, pediatric dentistry residents, and specialists in pediatric dentistry using a questionnaire that divides EP into three domains (dental procedures, dose/medication, and heart condition).

MATERIAL AND METHODS

The study was approved by the Research Ethics Committee of the School of Stomatology at the Autonomous University of San Luis Potosí (code CEIFE-006-010). The design is cross-sectional and the study included all the senior dental students, pediatric dentistry residents, and specialists in pediatric dentistry who agreed to answer a questionnaire.

The questionnaire consisted of two parts; the first gathered demographic data (gender, age, and years of graduation) and the second analyzed the respondents' knowledge about EP use, dose/medication, and associated heart conditions. We designed the questionnaire and submitted it to peer construct evaluation and internal validation.

In the first question of dental procedures participants should select the dental procedures in which EP is necessary; in the second they should select the cases in which EP is not necessary, and in the third they tested their knowledge about the current guidelines based on the National Institute for Health and Clinical Excellence guidelines (NICE) and AHA and ESC guidelines.

The dose/medication section evaluated the participants' knowledge on drug of choice for EP (amoxicillin), the adequate dose (50 mg/kg), and the optimum time for EP prescription (one hour before a dental procedure).

The section on heart condition tested the respondents' knowledge about the kind of diseases in which EP is necessary as well as on the difference between EP and antibiotic prophylaxis and which heart condition is at most risk for the development of IE after a dental procedure.

STATISTICAL ANALYSIS

Data were collected and analyzed using the statistical package R v.3.0.1 (The R Development Team, 2013) at a 95% confidence level. To evaluate the degree of knowledge of the three study groups in the three domains proposed in the questionnaire, an ANOVA analysis was performed and the results were adjusted for multiple comparisons with Tukey post hoc tests.

RESULTS

A total of 155 participants completed the questionnaire: 124 (80%) senior dental students (group 1), 13 (8.4%) pediatric dentistry residents (group 2), and 18 (11.6%) specialists in pediatric dentistry (group 3). Of the total of respondents, 99 (63.8%) were women and 56 (31.6%) were men. The demographic characteristics of the participants are shown in *Table 2*.

We stratified the knowledge on EP into three areas: dental procedures, dose/medication, and heart condition.

In the dental procedure area, there were no significant differences in the proportion of correct answers between group 1 (71.77%) and groups 2 (61.54%, $p = 0.72$) and 3 (77.78%, $p = 0.85$). No significant differences were either observed in the proportion between group 2 and group 3 (61.54 vs 77.78%, $p = 0.58$) (*Figure 1*).

In the dose/medication area, the proportion of correct answers between group 1 (49.19%) and group 2 (84.62%) and between group 1 and group 3 (38.89%, $p = 0.684$) showed no significant differences ($p = 0.067$). However, a statistically significant difference was found for the proportion of correct answers between group 2 and group 3 (84.62 vs 38.89%, $p = 0.044$) (Figure 2).

In the heart condition area, the proportion of participants who answered correctly (35.48%) in group 1 was not significantly different from that in group 2 (53.85%, $p = 0.40$) or in group 3 (44.44%, $p = 0.74$). Neither were there significant differences between group 2 and group 3 (53.85 vs 44.44%, $p = 0.86$) (Figure 3).

Table 3 describes the proportions of correct answers for each area of knowledge and study group.

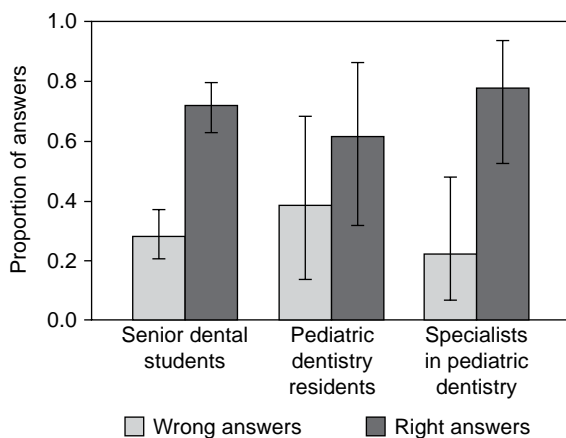


Figure 1: Proportion of responses regarding dental procedures by study groups.

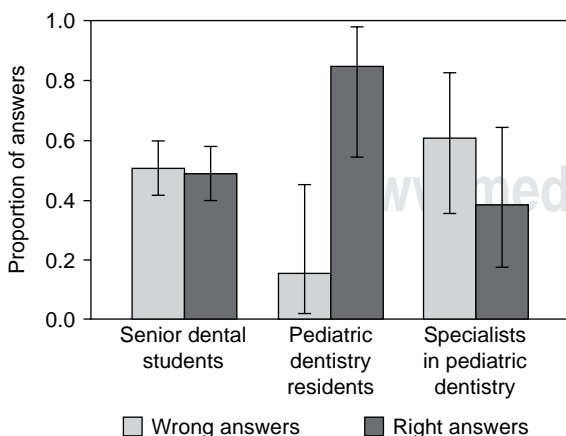


Figure 2: Proportion of responses in the dose/medication area by study groups.

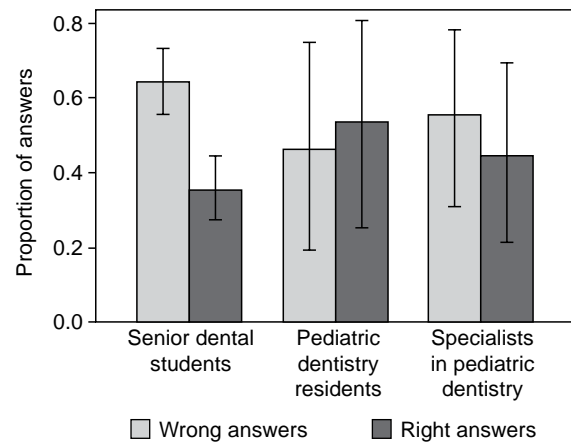


Figure 3: Proportion of responses in the heart condition domain by study groups.

DISCUSSION

IE is a rare disease, but once the patient has been affected by it the prognosis is poor.¹³ Several studies have shown that even with the use of prophylactic antibiotic regimens in all susceptible patients, the rate of IE is only reduced by 3.5-0.9%.¹⁶ However, the risk of IE after dental procedures in a population at high risk is minimal (1 in 95.000). Therefore, possible side effects and high cost of treatment should be considered for EP use.

The present investigation evaluated the knowledge of EP in some groups of dentistry professionals. The assessment tool was designed to stratify the knowledge about EP into three major areas. Studies similar to ours have evaluated the knowledge of health professional regarding EP stratifying the areas of knowledge like we did. Most of them, however, collected the answers in an indirect way, the questionnaires being sent by mail or electronic means with the entailing disadvantages. In addition, the studied population represented only a group of dentists.⁶

Overall, our results showed no statistically significant differences. By area of knowledge, we observed that a high proportion of participants in the three groups knew what dental procedures require EP and what others do not, a proportion that is similar to that found in other studies.¹⁰

In regard to knowledge on current guidelines about EP, the proportion of correct answers in the three groups revealed a low or out-of-date knowledge, thus making necessary for academic areas to implement measures or programs aimed at updating that information and keeping dental professionals updated since the guidelines are constantly changed or modified.

With respect to dose/medication and knowledge on the drug of first choice and the required dose the group best informed was that of pediatric dentistry residents, perhaps because, unlike senior dental students or specialists in pediatric dentistry, they must have this information more on hand due to the constant flow of patients attending the postgraduate pediatric dentistry clinic.

The third question referred to the time of EP use. The AHA's guidelines indicate that amoxicillin should be administrated one hour before dental procedure. In this respect a little less than half of specialists in pediatric dentistry with experience in the clinical area knew the time to use EP, which is of great concern because as professionals with long private or institutional practice they should have a better knowledge on this issue. This reflects the need to keep them informed and updated through courses or workshops that are provided by the San Luis Potosi's Pediatric Dentistry Association.

As for the knowledge on heart conditions that require EP, we observed that no group knew what heart conditions make EP use necessary, and in a significant percentage they lacked the knowledge to differentiate EP from antibiotic prophylaxis.

The lowest percentages of correct answers in all groups corresponded to the classification of cardiac conditions into high, medium, and low risk of IE in

dental procedures. Once again, it is evident the need for implementing educational programs that cover the three surveyed areas of knowledge to keep the information up to date.

Ghaderi et al.⁶ conducted a cross sectional analytical study including 150 dentists who were given a self-report questionnaire that consisted of three sections: 1) knowledge about the cardiac conditions that require prophylaxis, 2) knowledge of dental procedures that need prophylaxis, and 3) regime of prophylaxis used. Ninety three percent of respondents were aware that EP is essential for dental extractions, most participants did not believe in prophylaxis for noninvasive procedures (such as extraction of primary teeth, dental impressions, or X-rays), 75% rated amoxicillin as the antibiotic of choice, and 57% were familiar with the correct dose of amoxicillin for high-risk patients.

Eskandari et al.¹⁰ carried out a descriptive and analytical study with a sample of the same size as ours. The percentage of knowledge among participants in the three areas —heart diseases that need prophylaxis, dental procedures that require prophylaxis, and antibiotic use for EP— was 63.7, 66.8 and 47.7%, respectively. Their overall level of knowledge on EP was 59%. The association between level of knowledge and age and time of practice was statistically significant ($p < 0.05$). However, the level of knowledge was not

Table 3: Percentage of correct responses to the questions in each knowledge area by study groups.

Area of knowledge	Senior dental students (%)	Pediatric dentistry residents (%)	Specialists in pediatric dentistry (%)
Area 1: Dental procedures			
Question			
Regarding procedures that require endocarditis prophylaxis	94.35	84.61	94.44
Regarding procedures that do not require endocarditis prophylaxis	83.06	100.00	94.44
Regarding knowledge on the new guidelines on endocarditis prophylaxis (NICE, ESC, AHA)	37.90	0.00	50.00
Area 2: Dose and medication			
Question			
Concerning knowledge on first drug of choice for endocarditis prophylaxis	29.84	84.61	16.66
Concerning the indicated dose of first drug of choice	38.70	92.30	55.55
Concerning the time of endocarditis prophylaxis use	84.67	84.61	55.55
Area 3: Heart condition			
Question			
Relative to the type of cardiac condition that makes endocarditis prophylaxis necessary	29.03	61.53	33.33
Regarding knowledge on the difference between endocarditis prophylaxis and antibiotic prophylaxis	19.35	46.15	66.66
Concerning knowledge on cardiac conditions with high, medium, and low risk of presenting infective endocarditis in a dental procedure	58.06	53.84	50.00

significantly associated with sex or university in any of the three assessed areas ($p > 0.05$).

Ahmadi-Motamayel et al.¹⁷ conducted a study comparing the level of knowledge on EP between two different groups, graduated students and dentistry students, and found a percentage of general knowledge of about 65 and 56%, respectively. The knowledge of the students was better at 94.9%, and to that of graduates corresponded 82.3%. The general level of awareness of the studied groups was moderated; sex had no effect on the results but there was a statistically significant relationship between age and level of knowledge.

The stratification of the knowledge about EP allows for a simple way of evaluation and it is even possible to identify the areas of knowledge requiring updating.

By determining the level of knowledge on EP as shown in this study we could determine that none of the studied groups had a suitable knowledge regarding dental procedures. On the other hand, the 3 groups obtained an acceptable knowledge as to dose and medications, but only the pediatric dentistry residents obtained an appropriate percentage.

About heart conditions, none of the groups was adequately qualified, which shows the need to maintain a constant updating in the areas of dose and medications and heart conditions.

In summary, our results reveal that it is necessary to re-evaluate the way in which the knowledge on EP is imparted and to implement new strategies for adequate updates, because it is our duty to master all aspects of our practice, especially those that may endanger the patient's life.

Original research

Profilaxis para pacientes con endocarditis en la práctica dental: evaluación del conocimiento entre estudiantes de odontología, residentes de odontopediatría y odontopediatras

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RESUMEN

Objetivo: El propósito de este estudio fue determinar el grado de conocimientos acerca de la profilaxis para endocarditis entre los estudiantes de odontología, residentes de odontología pediátrica y odontopediatras, e identificar las áreas que requieren atención y reforzamiento. **Materiales y métodos:** Se realizó un estudio transversal con 155 participantes divididos en tres grupos de estudio; se les dio un cuestionario para evaluar el conocimiento de la profilaxis antiendocarditis, que consistía en tres áreas: procedimientos dentales, dosis/medicamentos y condición cardiaca. Los datos fueron analizados utilizando análisis de varianza (ANOVA), a través de modelos lineales generalizados. **Resultados:** Se estratificó el conocimiento de la profilaxis antiendocarditis en tres áreas: procedimientos dentales (sin diferencias significativas), dosis/medicación con diferencias estadísticamente significativas entre el grupo dos y tres (84.62 vs 38.89%, $p = 0.044$), y condición cardiaca sin diferencias significativas, pero con porcentajes bajos (35.48, 53.85, y 44.44%). **Conclusión:** El estudio identificó un grado de conocimiento inadecuado de los procedimientos dentales en los tres grupos, teniendo mayor conocimiento en el área de dosis/medicamentos los residentes de odontología pediátrica. Se encontró que el área de condición cardiaca es la que requiere más atención y reforzamiento en los tres grupos. Es necesario fortalecer el conocimiento de la profilaxis para endocarditis en los programas de estudios de pregrado y postgrado, y fomentar en los odontopediatras el interés por mantenerse actualizados en este tema.

Palabras clave: Profilaxis antibiótica, endocarditis, conocimiento, atención dental.

REFERENCES

1. Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, Levison 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): 1736-1754.
2. Wray D, Ruiz F, Richey R, Stokes T; Guideline Development Group. Prophylaxis against infective endocarditis for dental procedures-summary of the NICE guideline. *Br Dent J*. 2008; 204 (10): 555-557.
3. Lam DK, Jan A, Sándor GK, Clokie CM; American Heart Association. Prevention of infective endocarditis: revised guidelines from the American Heart Association and the implications for dentists. *J Can Dent Assoc*. 2008; 74 (5): 449-453.
4. National Institute for Health and Care Excellence. *Prophylaxis against infective endocarditis: antimicrobial prophylaxis against infective endocarditis in adults and children undergoing interventional procedures* [on line]. London: National Institute for Health and Clinical Excellence (UK); 2008. Available from: <https://www.nice.org.uk/guidance/cg64>
5. Mang-de la Rosa MR, Castellanos-Cosano L, Romero-Perez MJ, Cutando A. The bacteremia of dental origin and its implications in the appearance of bacterial endocarditis. *Med Oral Patol Oral Cir Bucal*. 2014; 19 (1): e67-e74.
6. 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)*. 2013; 14 (1): 6-12.
7. Al-Karaawi ZM, Lucas VS, Gelbier M, Roberts GJ. Dental procedures in children with severe congenital heart disease:

- a theoretical analysis of prophylaxis and non-prophylaxis procedures. *Heart*. 2001; 85 (1): 66-68.
8. Maestre Vera JR, Gómez-Lus Centelles ML. Antimicrobial prophylaxis in oral surgery and dental procedures. *Med Oral Patol Oral Cir Bucal*. 2007; 12 (1): E44-E52.
 9. Ferrieri P, Gewitz MH, Gerber MA, Newburger JW, Dajani AS, Shulman ST et al. Unique features of infective endocarditis in childhood. *Circulation*. 2002; 105 (17): 2115-2126.
 10. 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 (1): 15-19.
 11. Thompson SA, Davies J, Allen M, Hunter ML, Oliver SJ, Bryant ST et al. Cardiac risk factors for dental procedures: knowledge among dental practitioners in Wales. *Br Dent J*. 2007; 203 (10): E21; discussion 590-591.
 12. Habib G, Lancellotti P, Antunes MJ, Bongiorni MG, Casalta JP, Del Zotti F et al. 2015 ESC Guidelines for the management of infective endocarditis: The Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM). *Eur Heart J*. 2015; 36 (44): 3075-3128.
 13. Al-Fouzan AF, Al-Shinaiber RM, Al-Baijan RS, Al-Balawi MM. Antibiotic prophylaxis against infective endocarditis in adult and child patients. Knowledge among dentists in Saudi Arabia. *Saudi Med J*. 2015; 36 (5): 554-561.
 14. Palmer NA, Pealing R, Ireland RS, Martin MV. A study of prophylactic antibiotic prescribing in National Health Service general dental practice in England. *Br Dent J*. 2000; 189 (1): 43-46.
 15. Ellervall E, Brehmer B, Knutsson K. How confident are general dental practitioners in their decision to administer antibiotic prophylaxis? A questionnaire study. *BMC Med Inform Decis Mak*. 2008; 8: 57.
 16. Lauber C, Compton S, Lalh SS, Grace M, Smith MH, West MH et al. Antibiotic prophylaxis practices in dentistry: a survey of dentists and physicians. *J Can Dent Assoc*. 2007; 73 (3): 245.
 17. 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.

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