

# Research Paper: Prescription of Antibiotics and Corticosteroids Following Endodontic Procedures: Study of General Dentists in Qazvin, Iran



Maryam Ghamari<sup>1</sup>, Anita Ebrahimi Khaneghah<sup>2</sup>, Fateme Sefidi<sup>3</sup>, Sharareh Ghasemi<sup>4\*</sup>

1. Assistant Professor, Department of Endodontics, School of Dentistry, Qazvin University of Medical Sciences, Qazvin, Iran.

2. Assistant Professor, Department of Pediatric Dentistry, School of Dentistry, Qazvin University of Medical Sciences, Qazvin, Iran.

3. PhD. Student, Department of Educational Psychology, School of Education, Zanjan Branch, Islamic Azad University, Zanjan, Iran.

4. Assistant Professor, Department of Restorative Dentistry, School of Dentistry, Hamadan University of Medical Sciences, Hamadan, Iran.



**Citation:** Ghamari M, Ebrahimi Khaneghah A, Sefidi F, Ghasemi Sh. Prescription of Antibiotics and Corticosteroids Following Endodontic Procedures: Study of General Dentists in Qazvin, Iran. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2018; 7(3):115-122. <http://dx.doi.org/10.32598/3dj.7.3.115>

**doi** <http://dx.doi.org/10.32598/3dj.7.3.115>



## Article info:

**Received:** 15 Feb 2018

**Accepted:** 11 Jul 2018

**Available Online:** 01 Sep 2018

## Keywords:

Anti-bacterial agents, Adrenal cortex hormones, Endodontics, Therapeutics

## ABSTRACT

**Introduction:** Antibiotic resistance is an alarming development. One of the major causes of antibiotic resistance is the improper prescription of antibiotics. This study sought to assess prescription of antibiotics and corticosteroids following endodontic procedures by general dentists practicing in Qazvin City, Iran.

**Materials and Methods:** This descriptive cross-sectional study was conducted on all 108 general dentists practicing in Qazvin City, Iran in 2016. The relevant data were collected using a questionnaire. Then, the obtained data were analyzed via Chi-square test, ANOVA, Independent t-test, and Pearson correlation test using SPSS version 20.

**Results:** The first and second choice antibiotics prescribed by general dentists for patients not allergic to penicillin were penicillin V (35.1%) and amoxicillin (20.8%). For allergic patients, clindamycin (29.9%) and metronidazole (20.8%) were the first and second choice. Most dentists (44.2%) prescribed antibiotics for cellulitis. In case of persistence of systemic signs/symptoms of infection for more than 2-3 days, 24.7% of dentists prescribed penicillin injection and 23.4% prescribed metronidazole. For life-threatening infections, 44.2% prescribed amoxicillin plus metronidazole and 16.1% prescribed amoxicillin plus clavulanic acid. None of the responses for antibiotic prophylaxis were complete. Regarding the administration of corticosteroids, 40.3% preferred extra-oral intramuscular injection and 13% preferred tablets. Regarding contraindications for corticosteroid therapy, 9.1% of dentists gave a correct response. There was no significant correlation between gender and information ( $P=0.48$ ), but the correlation between age and information was inverse and statistically significant ( $P=0.04$ ).

**Conclusion:** The majority of contributed dentists in this study had insufficient information and needed further educational courses in this respect.

## \* Corresponding Author:

**Sharareh Ghasemi, PhD.**

**Address:** Department of Restorative Dentistry, Dental School, Hamadan University of Medical Sciences, Hamadan, Iran.

**Tel:** +98 (912) 3827860

**E-mail:** shararee88@yahoo.com

## 1. Introduction

**O**dontogenic infection is a poly-microbial infection [1]. Antibiotic prescription should be limited to acute abscess, presence of systemic signs and symptoms of periradicular infection, persistent exudate, symptomatic cases, and prevention of bacterial endocarditis [2]. However improper prescription of antibiotics can have side effects [3], such as development of antibiotic resistance [4].

Several strategies have been investigated for pain relief after root canal therapy such as narcotics, analgesics, intracanal and systemic corticosteroid, Non-Steroidal Anti-Inflammatory Drugs (NSAID) use, pulpotomy, partial pulpectomy and total pulpectomy. However, mild postoperative pain lasting for more than 72 hours is often managed by NSAIDs or acetaminophen [5, 6]. Corticosteroids are able to alleviate moderate to severe pain [7]. In light of these reports, this study aimed to assess prescription of antibiotics and corticosteroids after endodontic intervention by General Dentists (GDs) practicing in Qazvin, Iran.

## 2. Materials and Methods

This descriptive, cross-sectional study was conducted on all GDs practicing in Qazvin City in 2016. The inclusion criteria were having a DDS degree and practicing in Qazvin. The exclusion criterion was unwillingness for participation in the study. The relevant data were collected using a researcher-designed two-part questionnaire. The first part asked for demographic data, including age, gender, graduation year, place of study, work experience, and sector of practice (private practice/ public service).

The second part included questions regarding prescription of antibiotics and corticosteroids following endodontic procedures. This part of questionnaire included 16 questions. After designing the questionnaire, its validity was confirmed by the Shool members of the Endodontic Department of Qazvin University of Medical Sciences, School of Dentistry. The Cronbach  $\alpha$  and test-retest were calculated to be 0.8 and 0.76 for reliability. The authors distributed the questionnaires in person among the dentists. They were first informed about the purpose of study and ensured about the confidentiality of their information.

After signing an informed consent form, the questionnaires were filled out by dentists anonymously. Phone number of one of the authors was written at the bottom of the questionnaire for contact. The next day, the questionnaires were collected by the authors and dentists were

provided with correct answers. The answers were coded and data were analyzed using SPSS version 20 (SPSS Inc. IL, USA). The Mean $\pm$ SD of variables were reported. The Chi-square test, ANOVA and Independent t-test were used to compare the collected data. The Pearson correlation coefficient was used to assess possible correlations. All tests were carried out at 95% confidence interval and  $P < 0.05$  was considered as statistical significance.

## 3. Results

Of 108 GDs, 77 contributed in this study. 26 (33.8%) were females and 51 (66.2%) were males. The majority of GDs ( $n=38$ , 49.4%) had been graduated from Tehran University of Medical Sciences. The Mean $\pm$ SD age of GDs was  $38.61 \pm 8.55$  year. Their Mean $\pm$ SD work experience was  $10.96 \pm 7.67$  year. The majority of GDs had private practice ( $n=26$ , 34%). Regarding the choice of antibiotic for endodontic infection in patients not allergic to penicillin, penicillin V ( $n=27$ , 35.1%) ranked first and amoxicillin ( $n=16$ , 20.8%) ranked second. Regarding the antibiotic of choice for endodontic infection in patients allergic to penicillin, clindamycin (correct answer), [8] ranked first ( $n=23$ , 29.9%) and second was metronidazole ( $n=16$ , 20.8%).

Regarding the prescription of antibiotics for different conditions of pulp and periapical disease, the highest frequency of antibiotic prescription belonged to cellulitis (correct answer) ( $n=34$ , 44.2%), followed by pulp necrosis along with sensitivity to percussion test and preoperative pain and swelling before treatment plus cellulitis ( $n=9$ , 11.7%). Regarding the duration and dosage of antibiotics prescribed by dentists for non-allergic patients, 20.8% ( $n=16$ ) of GDs prescribed 500 mg penicillin V four times a day (correct answer) [9], 15.6% prescribed penicillin V three times a day and 14.3% prescribed 500 mg amoxicillin four times a day.

For allergic patients, 37.7% ( $n=29$ ) prescribed 300 mg clindamycin four times a day (correct answer) [8], and 26% ( $n=20$ ) prescribed 150 mg clindamycin four times a day. As regards persistent infection for more than 2-3 days after endodontic treatment, penicillin injection was prescribed by 24.7% ( $n=19$ ) while metronidazole (correct answer) [10], was prescribed by 23.4% ( $n=18$ ). Regarding life threatening infections, 44.2% ( $n=34$ ) prescribed amoxicillin plus metronidazole and 16.9% ( $n=13$ ) prescribed amoxicillin plus clavulanic acid (correct answer) [10].

According to Table 1, 28.6% and 13% of GDs knew the correct answer [1, 11]. Only one dentist selected both

**Table 1.** Frequency of antibiotics prescribed by GDs for different conditions

Antibiotic Prescription	No.(%)
Fever and malaise	22(28.6)
Avulsion	10(13)
Prevention of flare up	8(10.4)
Fever, malaise, and avulsion	6(7.8)
Endodontic retreatment	5(6.5)
Incision and drainage	4(5.2)
Fever and malaise following incision and drainage and endodontic surgery	4(5.2)
Endodontic retreatment, fever and malaise	3(9.3)
Prevention of flare up, draining sinus tract, endodontic surgery	2(2.6)
Draining sinus tract	1(1.3)
Endodontic surgery	1(1.3)
Endodontic retreatment, avulsion	1(1.3)
Fever, malaise, incision and drainage	1(1.3)
Incision and drainage, avulsion	1(1.3)
Incision and drainage, draining sinus tract, endodontic surgery	1(1.3)
Fever, malaise, avulsion	1(1.3)
All of the above	4(5.2)
No response	1(1.2)

correct answers. Based on [Table 2](#), the correct answer was acute heart failure, cardiac valve replacement, heart transplantation and recent joint replacement [12, 13]. None of GDs gave a complete correct response to this question. [Table 3](#) revealed that only 6.5% chose the correct response, which was instrumentation beyond the apex, periodontal ligament injection and apical surgery [14]. In response to maxillary central incisor avulsion in a 7-year-old boy, 28.6% (n=22) of dentists prescribed penicillin V after replantation and splinting in the first session and 9.1% (n=7) prescribed doxycycline.

Since both choices were correct [11], 37.7% gave a correct response. Regarding the route of administration of corticosteroids, 40.3% (n=31) chose extra-oral intramuscular injection; 13% (n=10) chose tablets and 9.1% (n=7) both. Regarding use of corticosteroids in conjunction with other drugs, 32.5% (n=25) reported using dexamethasone plus antibiotics and 22.1% (n=17)

reported using dexamethasone plus NSAIDs. [Table 4](#) shows that only 9.1% (n=7) gave a correct answer, since the correct answer was fungal infections and hypersensitivity to corticosteroids [6].

Regarding the need for administration of corticosteroids, 27.3% mentioned hypochlorite accident and 24.7% reported irreversible pulpitis with moderate to severe pain; 19.5% (n=15) reported pulp necrosis with periapical radiolucency and 50.7% (n=39) reported moderate to severe pain, necrosis and pulpitis. The common analgesics prescribed for severe pain following endodontic treatment were NSAIDs, opioids and corticosteroids (correct answer) [7] by 48.1% (n=37), and NSAIDs, corticosteroids and opioids by 27.3%. Most dentists (n=50, 64.9%) stated that they would prescribe acetaminophen plus codeine for patients with gastrointestinal problems (correct response) [15]. The overall Mean±SD score of

**Table 2.** Conditions necessitating antibiotic prophylaxis before endodontic treatment

Conditions Requiring Antibiotic Prophylaxis	No.(%)
Acute heart failure, mitral valve prolapse, coronary bypass, valve replacement, heart transplantation	11(14.3)
Valve replacement	8(10.4)
Acute heart failure	5(6.5)
Mitral valve prolapse, valve replacement	5(6.5)
Heart transplantation, recent joint replacement, plate, screw or pin in the joint	4(5.2)
Acute heart failure, coronary bypass	4(5.2)
Mitral valve prolapse	3(3.9)
Acute heart failure, mitral valve prolapse, coronary bypass	–
Valve replacement, heart transplantation	3(3.9)
Valve replacement, recent joint replacement, plate, screw or pin in the joint	3(3.9)
Acute heart failure, mitral valve prolapse, valve replacement, recent joint replacement	3(3.9)
Coronary bypass, valve replacement, heart transplantation	3(3.9)
Coronary bypass	2(2.6)
Heart transplantation	2(2.6)
Recent joint replacement	2(2.6)
Coronary bypass, valve replacement, recent joint replacement	2(2.6)
Mitral valve prolapse, coronary bypass, valve replacement, heart transplantation, plate, screw or pin in the joint	2(2.6)
Acute heart failure, valve replacement	2(2.6)
Plate, screw or pin in the joint	1(1.3)
Acute heart failure, mitral valve prolapse	1(1.3)
Acute heart failure, valve replacement, heart transplantation, recent joint replacement	0(0)
All of the above	4(5.2)
No response	4(5.2)

knowledge of dentists was  $5.48 \pm 2.57$  (range 0 to 11). Score 6 (n=12, 15.6%) had the highest frequency.

### Statistical analysis

The Pearson correlation coefficient showed a significant inverse correlation between knowledge score and age ( $P=0.04$ ). The correlation of knowledge score and graduation year or work experience was not significant ( $P=0.887$ ). The Independent t-test showed no significant association between

knowledge score and gender ( $P=0.48$ ). ANOVA found no significant association between knowledge score and the university attended ( $P=0.63$ ) or working in private office or public service ( $P=0.25$ ).

### 4. Discussion

In this study, the list of antibiotics used in the questionnaire contained the most commonly prescribed antibiot-

**Table 3.** Need for antibiotic prophylaxis for different endodontic procedures based on the opinions of GDs

Procedure	No.(%)
Endodontic surgery	30(29)
Instrumentation beyond the apex and endodontic surgery	15(19.5)
Instrumentation beyond the apex, endodontic surgery and inferior alveolar nerve block	7(9.1)
Instrumentation beyond the apex, periodontal ligament injection, and endodontic surgery	5(6.5)
Instrumentation beyond the apex	4(5.2)
Inferior alveolar nerve block	4(5.2)
Intracanal post placement	2(2.6)
Periodontal ligament injection	2(2.6)
Periodontal ligament injection, endodontic surgery	2(2.6)
Instrumentation beyond the apex, inferior alveolar nerve block, periodontal ligament injection, endodontic surgery and endodontic treatment confined to the canal space	2(2.6)
Endodontic treatment confined to the canal space	0(0)
No response	4(5.2)



ics for oral infections [9]. The results showed that penicillin V was the first choice of most dentists and amoxicillin ranked the second (20.8%). In a study by Segura-Egea et al. amoxicillin was the antibiotic of choice. According to the guidelines, penicillin V is the antibiotic of choice for

common anaerobic and facultative anaerobic pathogens [16]. Amoxicillin is a wide-spectrum antibiotic. Thus, its use in an individual with a normal immune system increases the risk of bacterial resistance [17, 18].

**Table 4.** Use of corticosteroids in conjunction with other drugs

Combinations	No.(%)
Dexamethasone + antibiotics	25(32.5)
Dexamethasone + NSAIDs	17(22.1)
Dexamethasone + antihistamine	8(10.4)
Dexamethasone + codeine	5(6.5)
Dexamethasone + antibiotics and dexamethasone + antihistamine	2(2.6)
Dexamethasone + antibiotics and dexamethasone + NSAIDs and dexamethasone + codeine	1(1.3)
Dexamethasone + antibiotics and dexamethasone + NSAIDs	1(1.3)
Dexamethasone + antihistamine and dexamethasone + NSAIDs	1(1.3)
Dexamethasone + antibiotics and dexamethasone + codeine	1(1.3)
All of the above	4(5.2)
No response	12(15.6)



Regarding the route of administration and dosage of antibiotics, 20.8% reported prescribing 500 mg penicillin V four times a day; 79.4% of participants were not well aware of the correct dosage of chosen antibiotic. The first choices of antibiotic of dentists in our study in case of allergy to penicillin were clindamycin (29.9%) and metronidazole (20.8%), which was in agreement with the study by Martinez-Jimenez et al. who reported the first choice of antibiotic to be clindamycin (99%) [19].

In our study, 37.7% of GDs prescribed 300mg clindamycin four times a day and 26% prescribed 150 mg clindamycin four times a day. In our study, only 23.4% of dentists recommended metronidazole against obligate anaerobes and 24.7% prescribed penicillin injection for such patients. In life threatening conditions, simultaneous use of amoxicillin with clavulanic acid (co-amoxiclav) is required [20], which was reported by 16.9% of dentists in our study. Antibiotic prophylaxis is required in medically compromised patients with acute heart failure, valve replacement, heart transplantation and recent joint replacement [21]. None of the dentists gave a correct answer in this respect. Also, endodontic procedures requiring prophylaxis in patients include instrumentation beyond the apex and periodontal ligament injection; only 6.5% gave a correct answer in this regard [22].

All dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa need antibiotic prophylaxis for patients at highest risk [22]. Inadequate knowledge in this respect calls for further continuing education courses and greater emphasis on this topic in dental curricula. Moreover, 44.2% of dentists reported antibiotic prescription for cellulitis; 55.8% prescribed antibiotics for irreversible pulpitis with severe pain, pulp necrosis with or without periapical lesion, and sensitivity to percussion. It seems that concerns of dentists regarding pain or flare-up are responsible for their wrong approach (antibiotic prescription). However, the correct treatment in such cases is root canal cleaning and administration of analgesics for acute apical periodontitis. There is no need for antibiotic prescription in such cases [23]. Therefore, further instructions on correct use of antibiotics in endodontics are imperative.

Use of antibiotics in endodontics should be limited to the presence of fever, lymphadenopathy, malaise, or compromised cell immunity [24]. In our study, 28.6% of GDs prescribed antibiotics for fever and malaise, 13% for avulsion, and 10.4% for prevention of flare-up. Following avulsion and replantation and splinting of tooth in the first session, penicillin V or doxycycline is indi-

cated [11]. About 28.6% and 9.1% of GDs prescribed penicillin V and doxycycline for such cases in our study, respectively; 22.1% prescribed no antibiotics.

In case of avulsion, doxycycline is the antibiotic of choice and in case of risk of staining, penicillin V is the next best choice [11]. With regard to combined use of corticosteroids and other drugs, combination of dexamethasone and antibiotics, dexamethasone and NSAIDs and dexamethasone and antihistamine were reported by 32.5%, 22.1%, and 10.4% of GDs, respectively. According to a study by Stewart and Chilton [25], application of corticosteroids + antihistamine + antibiotics before or after conservative endodontic treatment is highly effective for decreasing acute symptoms postoperatively in case of severe infection, swelling or flare-up. However because corticosteroids have side effects, they are not routinely prescribed for systemic use for pain relief following root canal treatment. Several investigators have used them for pain management following root canal treatment [26].

In our study, only 9.1% of GDs gave a complete response to this question. Regarding the administration of corticosteroids, the only indication according to Bowden et al. is hypochlorite accident to resolve inflammation [27]. About 27.3% of GDs chose hypochlorite accident in our study. According to Torabinejad et al. corticosteroids decrease pain only in patients with moderate to severe pain [7]. In our study, 50.7% of GDs prescribed corticosteroids for moderate to severe pain. Systemic administration of steroids can significantly relieve moderate to severe pain in patients with pulp necrosis and periapical radiolucency [7].

In our study, 19.5% of GDs prescribed corticosteroids for pulp necrosis with periapical radiolucency. About 48.1% of GDs in our study reported prescribing NSAIDs, opioids and corticosteroids in case of severe post-endodontic pain. In patients with gastrointestinal problems, the analgesic choice of 64.9% of GDs in our study was acetaminophen plus codeine, which was a correct response [15]. The study reveals that participation of older dentists in education courses is significance.

## 5. Conclusion

The majority of contributed dentists had inadequate knowledge about prescription of antibiotics and corticosteroids. Thus, continuing education courses seems imperative in this respect.

## Ethical Considerations

### Compliance with ethical guidelines

There was no ethical considerations to be considered in this research.

### Funding

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

### Authors contribution's

Statistic analysis: Fateme Sefidi; Design and data collection: Maryam Ghamari, Anita Ebrahimi Khaneghah; Writing and data collection: Sharareh Ghasemi.

### Conflict of interest

The authors declared no conflict of interest.

## References

- [1] Garg AK, Agrawal N, Tewari RK, Kumar A, Chandra A. Antibiotic prescription pattern among Indian oral healthcare providers: A cross-sectional survey. *Journal of Antimicrobial Chemotherapy*. 2013; 69(2):526-8. [DOI:10.1093/jac/dkt351] [PMID]
- [2] Rodriguez-Núñez A, Cisneros-Cabello R, Velasco-Ortega E, Llamas-Carreras JM, Tórres-Lagares D, Segura-Egea JJ. Antibiotic use by members of the Spanish Endodontic Society. *Journal of Endodontics*. 2009; 35(9):1198-203. [DOI:10.1016/j.joen.2009.05.031] [PMID]
- [3] Miles M. Anesthetics, analgesics, antibiotics, and endodontics. *Dental Clinics of North America*. 1984; 28(4):865-82. [PMID]
- [4] Bansal R, Jain A. Overview on the current antibiotic containing agents used in endodontics. *North American Journal of Medical Sciences*. 2014; 6(8):351-8. [DOI:10.4103/1947-2714.139277] [PMID] [PMCID]
- [5] Brignardello-Petersen R. Pulpotomy, partial pulpectomy, and total pulpectomy reduced pain and thermal and chewing sensitivity in patients with molars with irreversible pulpitis. *The Journal of the American Dental Association*. 2017; 148(12):e207.
- [6] Liesinger A, Marshall FJ, Marshall JG. Effect of variable doses of dexamethasone on posttreatment endodontic pain. *Journal of Endodontics*. 1993; 19(1):35-9. [DOI:10.1016/S0099-2399(06)81039-3]
- [7] Torabinejad M, Cymerman JJ, Frankson M, Lemon RR, Maggio JD, Schilder H. Effectiveness of various medications on postoperative pain following complete instrumentation. *Journal of Endodontics*. 1994; 20(7):345-54. [DOI:10.1016/S0099-2399(06)80098-1]
- [8] Segura-Egea JJ, Gould K, Şen BH, Jonasson P, Cotti E, Mazzoni A, et al. Antibiotics in endodontics: A review. *International Endodontic Journal*. 2017; 50(12):1169-84. [DOI:10.1111/iej.12741] [PMID]
- [9] Montgomery EH, Kroeger DC. Use of antibiotics in dental practice. *Dental Clinics of North America*. 1984; 28(3):433-53. [PMID]
- [10] Kuriyama T, Williams DW, Yanagisawa M, Iwahara K, Shimizu C, Nakagawa K, et al. Antimicrobial susceptibility of 800 anaerobic isolates from patients with dentoalveolar infection to 13 oral antibiotics. *Oral Microbiology and Immunology*. 2007; 22(4):285-8. [DOI:10.1111/j.1399-302X.2007.00365.x] [PMID]
- [11] Sae Lim V, Wang CY, Choi GW, Trope M. Effect of systemic tetracycline and amoxicillin on inflammatory root resorption of replanted dogs' teeth. *Endodontics & Dental Traumatology*. 1998; 14(5):216-20. [DOI:10.1111/j.1600-9657.1998.tb00842.x]
- [12] Little JW, Jacobson JJ, Lockhart PB. The dental treatment of patients with joint replacements: A position paper from the American Academy of Oral Medicine. *The Journal of the American Dental Association*. 2010; 141(6):667-71. [DOI:10.14219/jada.archive.2010.0255] [PMID]
- [13] Nishimura RA, Carabello BA, Faxon DP, Freed MD, Lytle BW, O'Gara PT, et al. ACC/AHA 2008 guideline update on valvular heart disease: Focused update on infective endocarditis: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines: Endorsed by the society of cardiovascular anesthesiologists, society for cardiovascular angiography and interventions, and society of thoracic surgeons. *Circulation*. 2008; 118(8):887-96. [DOI:10.1161/CIRCULATIONAHA.108.190377] [PMID]
- [14] Lockhart PB, Loven B, Brennan MT, Fox PC. The evidence base for the efficacy of antibiotic prophylaxis in dental practice. *The Journal of the American Dental Association*. 2007; 138(4):458-74. [DOI:10.14219/JADA.ARCHIVE.2007.0198]
- [15] Dionne RA, Lepinski AM, Gordon SM, Jaber L, Brahim JS, Hargreaves KM. Analgesic effects of peripherally administered opioids in clinical models of acute and chronic inflammation. *Clinical Pharmacology & Therapeutics*. 2001; 70(1):66-73. [DOI:10.1067/mcp.2001.116443] [PMID]
- [16] Segura-Egea JJ, Martín-González J, Jiménez-Sánchez MD, Crespo-Gallardo I, Saúco-Márquez JJ, Velasco-Ortega E. Worldwide pattern of antibiotic prescription in endodontic infections. *International Dental Journal*. 2017; 67(4):197-205. [DOI:10.1111/idj.12287] [PMID]
- [17] Baumgartner JC, Xia T. Antibiotic susceptibility of bacteria associated with endodontic abscesses. *Journal of Endodontics*. 2003; 29(1):44-7. [DOI:10.1097/00004770-200301000-00012] [PMID]
- [18] Khemaleelakul S, Baumgartner JC, Pruksakorn S. Identification of bacteria in acute endodontic infections and their antimicrobial susceptibility. *Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology*. 2002; 94(6):746-55. [DOI:10.1067/moe.2002.129535] [PMID]

- [19] Martín-Jiménez M, Martín-Biedma B, López-López J, Alonso-Ezpeleta O, Velasco-Ortega E, Jiménez-Sánchez MC, et al. Dental students' knowledge regarding the indications for antibiotics in the management of endodontic infections. *International Endodontic Journal*. 2018; 51(1):118-27. [DOI:10.1111/iej.12778] [PMID]
- [20] Shah A, Ramola V, Nautiyal V. Aerobic microbiology and culture sensitivity of head and neck space infection of odontogenic origin. *National Journal of Maxillofacial Surgery*. 2016; 7(1):56-61. [DOI:10.4103/0975-5950.196126] [PMID] [PMCID]
- [21] Daly CG. Antibiotic prophylaxis for dental procedures. *Australian Prescriber*. 2017; 40(5):184-8. [DOI:10.18773/aust-prescr.2017.054] [PMID] [PMCID]
- [22] 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):1736-54. [DOI:10.1161/CIRCULATIONAHA.106.183095]
- [23] Sutherland S, Matthews DC. Emergency management of acute apical periodontitis in the permanent dentition: A systematic review of the literature. *Journal-Canadian Dental Association*. 2003; 69(3):160-1. [PMID]
- [24] Bidar M, Gharechahi M, Soleimani T, Eslami N. A survey over the dentists' and endodontists' approaches towards the management of endodontic emergencies in Mashhad, Iran. *Iranian Endodontic Journal*. 2015; 10(4):256-62. [PMID] [PMCID]
- [25] Steward GG, Chilton NW. The role of antihistamines and corticosteroids in endodontic practice. *Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology*. 1958; 11(4):433-40. [DOI:10.1016/0030-4220(58)90081-1]
- [26] Iranmanesh F, Parirokh M, Haghdoost AA, Abbott PV. Effect of corticosteroids on pain relief following root canal treatment: A systematic review. *Iranian Endodontic Journal*. 2017; 12(2):123-30. [PMID] [PMCID]
- [27] Bowden JR, Ethunandan M, Brennan PA. Life-threatening airway obstruction secondary to hypochlorite extrusion during root canal treatment. *Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology*. 2006; 101(3):402-4. [DOI:10.1016/j.tripleo.2005.06.021] [PMID]