



## A Qualitative Systematic Review on Antibiotic Usage in Dentistry in India

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### Abstract

Antibiotics are medicines used to prevent and treat bacterial infections. Their use in health care has a beneficial impact on mankind to a considerable extent. Recent reports showing an increased use of prophylactic antibiotics by dental professionals; thus raising questions concerned on whether benefits of administering antibiotic prophylaxis outweigh its inherent risks. Present review aimed to assess antibiotic prescription patterns of Indian dental practitioners and to know the quality of reporting evidence through a qualitative review of literature of Indian origin. Electronic database search for published literature indexed in Google Scholar and PubMed been done using PICO format for inclusion of qualitative studies. Full text articles retrieved and categorized according to study design for assessing the quality of reporting using their respective standardized design based checklists. Search strategy identified a total of 715 studies, 30 of which met inclusion criteria and were selected and reviewed for further analysis, which revealed an increased prescription (65%) of antibiotics by dental practitioners, most commonly penicillin. Evaluation of quality of included studies using design-based checklists observed methodological flaws and statistical weaknesses in establishing findings represents the low quality of evidence. Present review witnessed low quality of published evidence regarding use of antibiotics by dentists. This review offered only a narrow conclusion on antibiotic prescription patterns by Indian dentists; insufficient literature support and low quality of scientific reporting were the major drawbacks. Extensive, large-scale research and standardized reporting are needed to provide high quality evidence to overcome the dilemmas in antibiotic prescription.

**Keywords:** Antibiotics; Dentistry; India; Systematic Review

### Introduction

The term "antibiotic" from Greek background, which means 'opposing life,' was first used by a Ukrainian-American inventor and medical microbiologist Selman Waksman in 1942. In 20<sup>th</sup> century, Alexander Fleming accidentally discovered the first antibiotic "Penicillin" for treatment of infections caused by bacteria. It was followed by the discovery of another group of antibiotics called sulphonamides [1] developed by the German biochemist Gerhard Domagk in 1930, a bacteriostatic drug that mainly acts by inhibiting bacterial growth and its multiplication. During initial days, penicillin was used successfully in vast amounts for the treatment

of diseases that occurred in military troops during World War II, which in that period referred to as a "wonder drug." Discovery of penicillin has marked a new beginning in the field of medicine, which was endeavored as the "golden era" of antibiotics between the years 1940 and 1962, during which most of the other antibiotics now being used commonly were found and introduced.

Bacterial infections are usually common in dental and oral clinical practice; this has paved way for the frequent use of antibiotics in the field of dentistry as a treatment modality [2], that led to over usage and over-prescription of antibiotics by dental professionals. Systemic antibiotics should be prescribed only as an adjunct to treat specific dental infections or used prophylactically to prevent

serious situations where there will be a chance of bacteremia or systemic involvement of infection; if not this overuse may lead to many adverse effects [3].

During the recent years, medical as well as dental professions have been experiencing an exponential rise in the use of systemic antibiotics for treating infections, in which dentistry alone contributes pronominally for about 10% of all common antibiotics globally [4]. Along with antibiotics, analgesic drugs also account for a huge majority of drugs prescribed by dental professionals [5]. According to the World Health Organization (WHO), antibiotics were reported as the most commonly misused drugs among all other medicines due to theories faces, benches Peran economical, familiar with generally good safety profiles, and also considering antibiotic abuse as a pandemic community issue [6].

It has been evident that there is an apparent lack of scientific evidence to prove that there are an over-prescription and overuse of antibiotics in dentistry. Also, there has been a lack of standard criteria and recommendations from the concerned health organizations. In addition to this, previously, many studies have observed that there is insufficient knowledge of standard antibiotic prescription guidelines among dental professionals.

With this view, the present systematic review has been schematized and conducted to know the extent of antibiotic use among Indian dental professionals and also to rule out the available quality of information associated with the same through qualitative evidence-based research of literature of Indian literature context.

### Materials and Methods

The research question for the present review was formulated using PICO framework criteria [7] and the protocol for the review was for prepared using PRISMA statement [8], for the selection and inclusion of relevant studies. An explicit electronic database search was conducted using Google Scholar and PubMed, using the keywords “antibiotic prescription”, ‘dental”, “India”, for the inclusion of study articles of Indian context published in English within a time frame of 10 years i.e. 2009 - 2010. Only two databases were chosen for conducting the search strategy, owing to the fact these two databases yield maximum amount of evidence.

A total of 715 studies were obtained from both the databases after exclusion of duplicates. Abstracts of all the obtained stud-

ies were screened. Studies that were irrelevant in terms of study design, methodology and inclusion criteria and studies that were not accessible for full text were excluded. Full text articles were obtained and assessed further, so as to be included in the final analysis.

Detailed PRISMA flowchart of the search protocol was given in figure 1. Studies published out of Indian context other than English language were excluded. Studies were also excluded if not specific to dental profession. Detailed search process following the inclusion criteria yielded a broad range of study designs including systematic reviews, randomized trials, observational studies and narrative reviews.

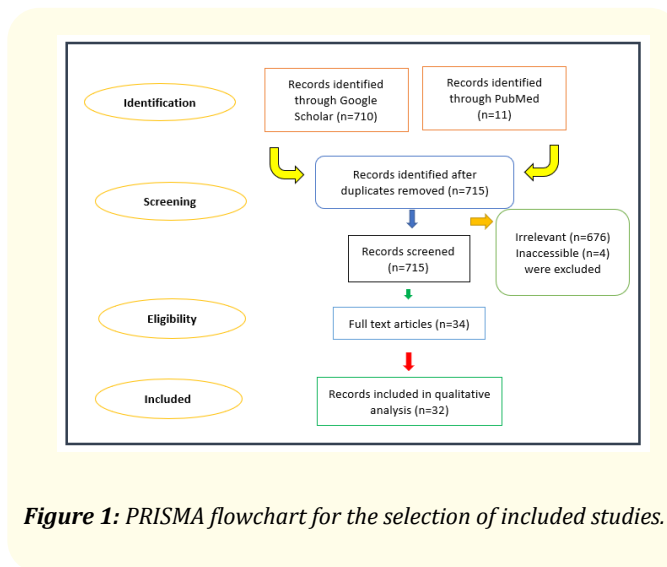


Figure 1: PRISMA flowchart for the selection of included studies.

### Data extraction

Data from the obtained articles were then extracted into pre-fabricated data extraction sheets. Information was retrieved from this data pertained to study design, number of study participants, inclusion and exclusion criteria, statistical analyses performed and outcomes obtained. After that, the resulted studies were subjected to quality assessment.

### Assessing the quality of the included studies

Qualitative data was assessed from the selected studies using design based quality checklists like PRISMA [9] statement for systematic reviews and meta-analyses, CONSORT [10] for randomized

trials, STROBE [11] checklist for observational studies and Narrative [12] checklist for narrative reviews. Checklist scores were totaled and each study was given the quality score pertaining to its respective study design.

**Statistical analyses**

Statistical analysis was performed using SPSS statistics ver. 20.0. Descriptive analyses were carried out to know the frequency of study participants prescribing antibiotics, predominantly amoxicillin and also to obtain the mean percentages of checklist scores attained from the quality assessment process which were given in table 1.

S. No	Type of Study Design	Number of Studies	Standard Checklist Used for Assessing Quality	Mean Percentage of Checklist Items Followed (%)
1.	Systematic Reviews	3	<b>PRISMA</b> (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)	48.14
2.	Randomized trials	5	<b>CONSORT</b> (Consolidated Standards of Reporting Trials)	55.2
3.	Observational studies	22	<b>STROBE</b> (Strengthening the Reporting of Observational Studies in Epidemiology)	37.8
4.	Narrative Reviews	2	Narrative Review Guidelines	62.5

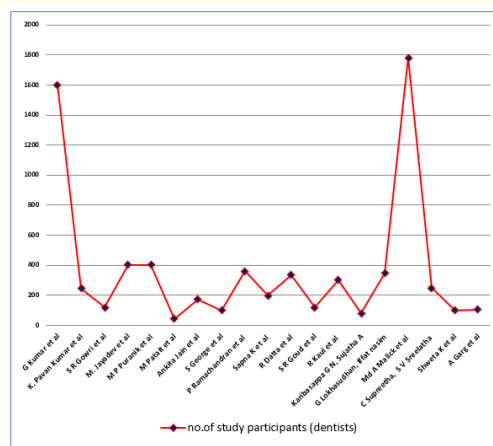
**Table 1:** Evaluation of the quality of studies included (as per standard checklists).

**Results and Discussion**

According to the search criteria followed 32 articles were included in the final qualitative analysis. Of which, majority (n = 22)

of the published articles were observational studies, only five of them were randomized trials and two were systematic reviews and the remaining were narrative reviews.

Of the included study designs, each of the observational studies were then put together and categorized according to the number of study participants (dentists) involved in the respective included studies as given in figure 2.



**Figure 2:** Number of participants (dentists) included from the selected studies.

Analysis of the frequencies of the number of dentists prescribing antibiotics in the included studies collectively, demonstrated that about sixty-five percent (65%) of Indian dentist practitioners were prescribing antibiotics, which was found to be quite superfluous. Two of the studies included in this review, conducted by G Kumar, et al. (2014) [5] and Md A Malick, et al. (2019) [13] found to be the only studies with maximum number of study participants, in which percentage of dentists prescribing antibiotics (predominantly amoxicillin) was also found maximum i.e. 73.4% and 69.5% respectively as shown in figure 3. Out of all the studies selected for the review, one among them was a questionnaire based study done by Shweta K., et al. (2015) [14] has observed a higher percentage (i.e. 90%) of antibiotic prescription by the dental practitioners in contrast to its less number of study participants.

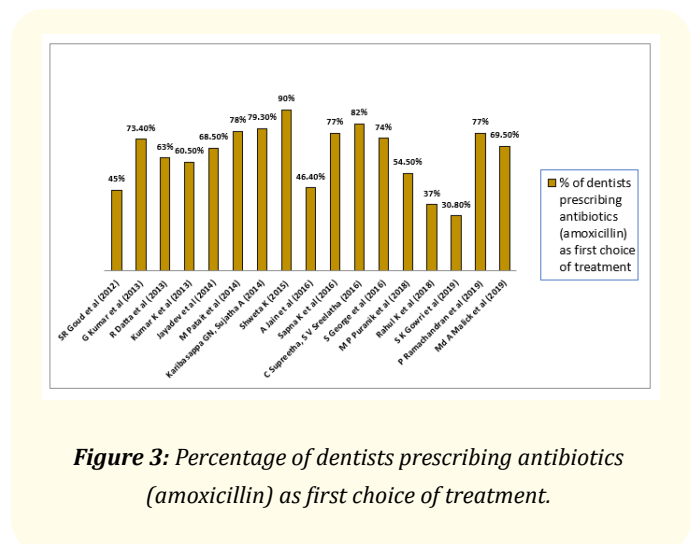
Brief assessment of five of the included randomized controlled trials involving study participants who were undergoing periodontal, orthognathic, endodontic and oral surgical procedures, in which the study authors have stated that there is no use of prophylactic antibiotics in all these procedural aspects when clear and strict

protocol was followed pre and post-operatively to avoid complications and the characteristics of these studies have been described in table 2. Also, all these clinical trials recommended necessity for further research on the usage of antibiotics in dentistry while suggesting and recommending a requisite for clear-cut guidelines on antibiotic use from global health agencies and drug control administrations.

Author and year	Study participants	Aim and objectives	Discussion
Iftikhar Akbar (2015) [21]	Patients undergoing root canal treatment (n = 100)	To assess the effect of prophylactic use of antibiotics to avoid flare up during root canal treatment of teeth with asymptomatic necrotic pulp.	Prophylactic use of amoxicillin in asymptomatic non-vital teeth before RCT has no effect on incidence of flare-up.
Oswal S., et al (2014) [20]	Patients undergoing periodontal surgery (n = 70)	To evaluate the need of antibiotics during periodontal surgeries in reducing post-op infections and to explore if antibiotics have any role in reducing complications.	Use of antibiotics should be based on procedural outcomes and not used blindly to be extra cautious. No statistical (P = 0.5) and clinical significance seen.
Danda AK and Ravi P (2011) [17]	Patients undergoing orthognathic surgery (150)	To evaluate the prophylactic value of single-dose vs single-day antibiotic on post-operative infection of orthognathic surgery	Clinically significant results obtained, but not statistically significance (P = 0.16).

R R Mo-han., et al (2014) [19]	Patients undergoing periodontal surgery (n = 45)	To evaluate role of antibiotics in preventing post-operative complications of periodontal surgery	Prophylactic antibiotics are unnecessary when strict protocol was followed for periodontal surgery.
Sekhar C H., et al (2001) [22]	Patients aged 19-36 years third molar surgery (n = 151)	To test the efficacy of 2 dosing regimens of antimicrobial prophylaxis during removal of impacted third molar	Pre-operative and post-operative antibiotic prophylaxis does not seem to reduce morbidity after removal of wisdom teeth.

**Table 2:** Randomized controlled trials showing the unimportance of antibiotics in dentistry.



**Figure 3:** Percentage of dentists prescribing antibiotics (amoxicillin) as first choice of treatment.

**Discussion**

From the acquired literature, it can be specified that majority of the evidence gathered for the present review regarding the use of

antibiotics in dentistry in India was obtained from observational studies (i.e. 22 out of 32 included studies) and only a few were experimental studies followed by literature reviews. All efforts were made to identify and include relevant studies and all included studies were subjected to their respective design based quality assessment criteria, from which it was found that there is presence of methodological deficiencies in reporting study settings, defining the variables and outcomes, inclusion of study participants and providing adequate statistical information, which all may pose an intense threat to the quality of the evidence.

While assessing the current study outcomes, it was found that there is a higher percentage (66.03%) of antibiotic over-prescription by dental practitioners in India, when compared to other countries like United Kingdom where it was only 40% [15]. In a global analysis report from national pharmaceutical sales data on antibiotic consumption from the previous decade i.e. 2000 to 2015 [16], it was revealed that there is a 36% increase in consumption of antibiotic drugs globally. In which India was the largest consumer of antibiotics in 2010 with 12.9 x 107 units with an average of 11 antibiotic pills per person in an year and also the report stated that between 2000 and 2015, antibiotic consumption increased from 3.2 to 6.5 billion (103%) DDDs (defined daily dosage) in India along with an increased antibiotic consumption rate from 8.2 to 13.6 DDDs per 1,000 inhabitants per day (63%), which confirms the surging use of antibiotic in India.

A qualitative systematic review and meta-analysis of randomized controlled trials done by Anil Kumar D and Ravi P (2011) [17] to evaluate the effectiveness of postoperative use of antibiotics during orthognathic surgery, found statistically significant differences ( $P > 0.01$ ) in rates of developing infection following orthognathic surgery. The authors concluded with certain limitations like less availability of related literature, less sample size and inadequate description on blinding procedures in some included studies, which have led to failure of providing qualitative evidence to support the use of antibiotics in orthognathic surgeries and also recommended need for large-scale experimental trials to establish the appropriate study objective. In addition, the results of the current review also found the same, suggesting the low quality of evidence.

Reviews done by Sharon K and J Priya (2018) [18] and Aidasani B., *et al.* (2019) [3] to investigate the evidence for over prescrip-

tion and to address the current pattern of antibiotic prescription in dentistry respectively, mentioned that the literature necessary to conclude the obtained evidence was limited. Even though both of the studies were published in standard peer reviewed journals, both of the studies found lacking methodological quality and credibility in reporting the evidence when subjected to their respective quality assessment tool (PRISMA checklist).

Present review included five randomized controlled trials concerned with evaluation of antibiotic use in periodontal, orthognathic and endodontic surgeries. Two of the studies were concerned with evaluation of antibiotics in periodontal surgeries done by Mohan RR., *et al.* (2014) [19] and S Oswal., *et al.* (2014) [20] and another study by A K Danda., *et al.* (2010) [17] concerned with evaluation of antibiotics in orthognathic surgery. All these studies found clinically significant differences like improvement in periodontal parameters like gingival and plaque scores and reduction of infection rates in post-orthognathic surgery, when prophylactic antibiotics were given. But they found no statistical significant difference ( $P > 0.05$ ). Hence the authors concluded that there is no influence of antibiotic administration on reducing post-operative complications and also recommended need for further experimental trials to prove the effectiveness of antibiotics. Another experimental trial by Iftikhar Akbar (2015) [21] had also found no effect of prophylactic use of amoxicillin on incidence of flare-up in asymptomatic non-vital teeth before root canal treatment and one more trial by C H Sekhar., *et al.* (2001) [22] to evaluate role of antibiotics in third molar surgeries also found that pre-operative and post-operative antibiotics prophylaxis does not seem to reduce morbidity after removal of wisdom teeth. That adds to the statement that antibiotics have no role in subsiding clinical complications in dental procedures when strict protocol was followed. As experimental studies were considered as gold standard for development of new interventions but in this case the quality of all these included studies was found low when assessed with their respective checklist (CONSORT) [10], all these five included trials failed to provide reliable evidence as they have methodological flaws like poor randomization and blinding procedures, in addition all these studies recommended further advanced research in finding the role of antibiotic usage in their corresponding specialties.

A questionnaire study done by Kelekar S., *et al.* (2015) [14] to evaluate the knowledge, pattern and rationality of antibiotic prescription among dental practitioners found that 90% of the study



participants were regularly prescribing antibiotics. In a similar study done by S George, *et al.* (2016) [23] on undergraduate dental students had found a higher percentage of antibiotic prescriptions by the study participants. Same results were observed in the current review with an overall percentage of antibiotic prescription above 60% that is somehow can be considered as superfluous. Same findings were observed in another observational study by Jayadev M., *et al.* (2014) [24] in which 56.4% of the study participants' i.e. dental practitioners were regularly prescribing antibiotics for teeth with acute apical periodontitis. Comparatively a study done by Pavan Kumar, *et al.* (2013) [25] has also found higher percentage (92%) of dentists prescribed antibiotics for treating pulpal and periapical pathologies. Similar trend of increased prescription of antibiotics was observed in many other studies done by M Patait, *et al.* (2014) [26], S R Gowri, *et al.* (2019) [27], R Datta, *et al.* (2014) [28], and S Konde, *et al.* (2016) [29] which were reported from various regions in India. This has emphasized the need for more educational initiatives to rationalize the use of antibiotics in dental practice. Given the significant amount of antibiotics prescribed by dental practitioners to patients with dental conditions, the paucity of high quality experimental studies evaluating the effects of antibiotic use were proven important. Even WHO also found an increase in antibiotic consumption occurring in countries that were having rapid economic expansion like India and China<sup>14</sup> and has recommended these countries to establish a national level surveillance system to monitor consumption and prescription of antibiotics.

Overall majority of the studies included in the current review were found to have many methodological flaws and statistical weaknesses as observed from their respective study quality assessment findings. Despite this, the current review also observed that many of these studies were substantially been published in a very high number of peer reviewed journals even though they were found qualitatively weak, which in addition may lead to diminished quality of research studies also ultimately affecting the quality of evidence.

In summary, the overall interpretation of the results observed from the current review may be generally limited because of the low quality of the included studies and also low quality of scientific reporting; however these findings may help discuss the importance of the topic in terms of clinical and public health significance. This review may also help in analyzing the trend of antibiotic

prescription by dental practitioners and provides an overview of antibiotic usage in India as this review included all types of study designs pertaining to general as well as specialized dental fields for enhancing the generalizability of study verdicts.

## Conclusion

Within the limitations, the present review witnessed over usage of antibiotics during routine dental procedures. From the study findings, it can also be said that review could offer only a narrow conclusion on antibiotic usage by dental practitioners in India after considering flaws in the included studies into account. Unfortunately, only few studies were included in this review of which, most of them were confounded with low quality reporting despite this it was also noticed that most of the journals were accepting studies without proper screening thus all resulting in low quality evidence. To avoid this, authors should be familiarized on reporting their evidence using standard o guidelines and also the reviewers should follow these guidelines in accepting and promoting evidence based research. A paucity of studies regarding antibiotics in India also suggests a necessity to perform further systematic and extensive research to gain better understanding of antibiotics which helps in providing high quality evidence to fraternity to overcome dilemmas related to prescription of antibiotics.

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## Conflict of Interest

None.

## Bibliography

1. Sneader W. Sulfonamides (The History). In Van Nostrand's Scientific Encyclopedia, G.D. Considine (Ed.), 2007.
2. Poveda-Roda R, Bagán JV, Sanchis-Bielsa JM, Carbonell-Pastor E. Antibiotic use in dental practice: A review. *Med Oral Patol Oral Cir Bucal.* 2007;12:E186-E192.
3. Aidasani B, Solankis M, Khetarpal S, Ravi SP. Antibiotics: their use and misuse in paediatric dentistry. A systematic review. *European journal of paediatric dentistry.* 2019;20(2):133-138.

4. Pallasch TJ. Global antibiotic resistance and its impact on the dental community. *Journal of the New Jersey Dental Association*. 2000;71(2):14-15.
5. 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*. 2014;69(2):526-528.
6. WHO's first global report (2020) on antibiotic resistance reveals serious, worldwide threat to public health. *World Health Organization (WHO)*, 2014.
7. Schardt C, Adams MB, Owens T, Keitz S, Fontelo P. Utilization of the PICO framework to improve searching PubMed for clinical questions. *BMC Medical Informatics and Decision Making*. 2007;7:16.
8. Moher D, Liberati A, Tetzlaff J, Altman DG. The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med*. 2009;7.
9. Schulz KF, Altman DG, Moher D, CONSORT Group. CONSORT 2010 statement: Updated guidelines for reporting parallel group randomised trials. *J Clin Epidemiol*, 2010;63:834-840.
10. Von Elm E, Altman DG, Egger M, Pocock SJ, Gotsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Med*. 2007;4:e296.
11. Baethge C, Goldbeck-Wood, S, Mertens S. SANRA-a scale for the quality assessment of narrative reviews articles. *Res Integr Peer Rev*. 2019;4.
12. Malick MD, Chaman C, Akhtar MS, Khan S, Yadav S, Agarwal A. Pattern of antibiotic prescription by indian dental practitioners in management of endodontic infections: (a survey). *Paripex-Indian Journal of Research*. 2019;8(2).
13. Kelekar S, Nilesh K, Malik NA, Malik PP. Knowledge and pattern of antimicrobial prescriptions by dental practitioners: a questionnaire based study. *Journal of Bio Innovation*. 2016;4(1):12-17.
14. MAO Lewis. why we must reduce dental prescription of antibiotics: European Union Antibiotic Awareness Day. *British Dental Journal*. 2008;205(10):537-538.
15. Thomas P Van Boeckel, Sumanth Gandra, Ashvin Ashok, Quentin Caudron, Bryan T Grenfell, Simon A Levin, Ramanan Laxminarayan. Global antibiotic consumption 2000-2010: an analysis of national pharmaceutical data. *Lancet Infect Dis*. 2014;1-9.
16. Danda AK, Ravi P. Effectiveness of postoperative antibiotics in orthognathic surgery: a meta-analysis. *Journal of Oral and Maxillofacial Surgery*. 2014;69(10):2650-2656.
17. Keziah VS, Priya J. A systematic review on the over-prescription of antibiotics causing antibiotic resistance. *Drug Invention Today*. 2018;10(11).
18. Mohan RR, Doraswamy DC, Hussain AM, Gundannavar G, Subbaiah SK, Jayaprakash D. Evaluation of the role of antibiotics in preventing postoperative complication after routine periodontal surgery: A comparative clinical study. *Journal of Indian Society of Periodontology*. 2014;18(2):205.
19. Oswal S, Ravindra S, Sinha A, Manjunath S. Antibiotics in periodontal surgeries: A prospective randomized cross over clinical trial. *Journal of Indian Society of Periodontology*. 2014;18(5):570.
20. Akbar I. Efficacy of Prophylactic use of Antibiotics to Avoid Flare up During Root Canal Treatment of Non-vital Teeth: A Randomized Clinical Trial. *Journal of clinical and diagnostic research: JCDR*. 2015;9(3):ZC08.
21. Sekhar CH, Narayanan V, Baig MF. Role of antimicrobials in third molar surgery: prospective, double blind, randomized, placebo-controlled clinical study. *British Journal of Oral and Maxillofacial Surgery*. 2001;39(2):134-137.
22. [Sosa George, Dhanraj Ganapathy, Shruti Pillai. Knowledge, attitude and practice on antibiotic therapy for pediatric patients among undergraduate dental students- a questionnaire survey. *Asian Journal of Pharmaceutical and Clinical Research*. 2016;9(6):215-217.
23. Jayadev M, Karunakar P, Vishwanath B, Chinmayi SS, Siddhartha P, Chaitanya B. Knowledge and pattern of antibiotic and non-narcotic analgesic prescription for pulpal and periapical pathologies-a survey among dentists. *Journal of clinical and diagnostic research: JCDR*. 2014;8(7):ZC10.
24. Kumar KP, Kaushik M, Kumar PU, Reddy MS, Prashar N. Antibiotic prescribing habits of dental surgeons in Hyderabad City, India, for pulpal and periapical pathologies: a survey. *Advances in Pharmacological Sciences*. 2013:1-4.
25. Patait M, Urvashi N, Rajderkar M, Kedar S, Shah K, Patait R. Antibiotic prescription: an oral physician's point of view. *Journal of Pharmacy & Bioallied sciences*. 2015;7(2):116.

26. Gowri S, Mehta D, Kannan S. Antibiotic use in dentistry: a cross-sectional survey from a developing country. *Journal of Orofacial Sciences*. 2015;7(2):90.
27. Datta R, Grewal Y, Batth JS, Singh A. Current trend of antimicrobial prescription for oral implant surgery among dentists in India. *Journal of maxillofacial and oral surgery*. 2014;13(4):503-507.
28. Konde S, Jairam LS, Peethambar P, Noojady SR, Kumar NC. Antibiotic overusage and resistance: A cross-sectional survey among pediatric dentists. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2016;34(2):145.

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