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Antibiotic Resistance - A looming health crisis: knowledge and attitude of pediatric dentists towards antibiotic prescription and their awareness about the antimicrobial resistance

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Abstract

Background: World Health Organization states that Antibiotic resistance is one of the biggest threats to global health today which has led to the disability to treat even common infections in children. Many orofacial infections have an odontogenic origin that requires the application of Antibiotics for their treatment exhibiting a wide range of use in Dentistry. The increase in bacterial resistance is mainly due the improper and indiscriminate misuse of antibiotics by various Health Professionals including Dentists.

The Objective of this study is to evaluate the antibiotic prescription pattern for management of various dental procedures amongst Pediatric dentists and to assess the knowledge and awareness of Antibiotic resistance amongst them. Hence, the present investigation aims to study the types and frequency of the antibiotic prescription designs for various dental procedures amongst Pediatric dentists.

Methods: A cross-sectional study was designed to assess the antibiotic prescribing practices of Pediatric dentists across the South India for various dental procedures including the management of odontogenic infections in children. A self-designed structured online questionnaire was formatted with both open and close ended questions. The questionnaire was designed to be self-administered amongst the randomly selected 100 pediatric dentists all across India and the dental professionals were contacted via email and other online platforms. The data collected will be computerized and

analyzed using the Excel sheet of Microsoft Office Professional Plus 2019, 64-bit system and format.

Results: The majority of the practitioners prescribed antibiotics for managing oral diseases. Amoxicillin was the most commonly prescribed antibiotic. With respect to the duration of antibiotic prescription, most of the respondents prescribed antibiotics as a 5-day course. Majority of the pediatric dentists calculated the pediatric dosages and considered modifying the antibiotics in evidence of a mixed infection. The knowledge regarding antibiotic prophylaxis and antibiotic resistance was found to be satisfactory amongst the respondents. However, there was a general lack of awareness regarding the AAPD guidelines for antibiotic prophylaxis for medically compromised children

Conclusion: The study showed there was a tendency amongst the pediatric dentists to overprescribe antibiotics in certain dental conditions that do not warrant an antimicrobial coverage. Nearly all respondents were aware of antibiotic resistance the guidelines for the prescription and prophylactic use of antibiotics for certain systemic conditions.

Keywords: Pediatric Dentistry, Antibiotic Resistance, Prescription, Practice, Procedure.

Introduction

Antibiotic resistance is the tolerance of a microorganism to an antibiotic that was initially effective for the treatment of infections caused by those microbes. This is one of the biggest threats to global health today leading to the disability to treat even common infections in children as highlighted by World Health Organization (2022)[1]. Infection remains a major problem in medical practice, and their rational treatment with drugs choice, considering its effectiveness with least adverse effect. Antibiotics are amongst the most frequently prescribed medications for the treatment and prevention of bacterial infection in modern medicine. The oral microbial flora grows in the newborn's mouth about eight hours after birth. This is followed by a continuous change in composition from when the child is edentulous until teeth emerge[2]. Oral infections are classified as odontogenic and non-odontogenic. Odontogenic infections are polymicrobial in nature involving a combination of gram-positive and gram-negative facultative anaerobes and strictly anaerobic bacteria. Therefore, the dentists routinely prescribe antibiotics for either therapeutic or prophylactic reasons for managing oral and dental infections. More often, dentists use adjunctive antibiotics such as those administered in conjunction with surgical intervention in case of the most endodontic infections. It has been noticed that some bacteria, including those implicated in apical periodontitis, are developing resistance to most antibiotics currently available [3]. Considering that dentists prescribe approximately 10% of all antibiotics commonly used, the impact of dentists on antimicrobial resistance is considerable [4]. Inadequate and extravagant utilization of antibiotics is one of the significant factors in its rise. There has been evidence of inadequate practices by dentists, manifested by over-prescribing antibiotics due to unsatisfactory knowledge or social factors. Moreover, the awareness of the threat of antibiotic resistance among healthcare workers particularly dentists is not consistent [5]. Hence, the present study intends to review the types and frequency of antibiotic prescription designs for the management of various dental procedures and to assess the knowledge and awareness of Antibiotic resistance among pediatric dentists.

Methods

A cross-sectional survey study was designed to assess the antibiotic prescribing practices of paediatric dentists

across South India for various dental procedures including the management of odontogenic infections in children. A structured questionnaire was formatted with both open and close-ended questions pertaining to the various types, dosages, indications of antibiotic prescription and the developing antibiotic resistance within the population.The questionnaire was designed to be self-filled amongst the randomly selected 100 pediatric dentists across South India (Table 1)for which the dental professionals were contacted via email and other online platforms via a Google form.

Table 1: The particulars of questionnaire designed for dental professionals

QUESTIONNAIRE

1. Age of the participant:
2. Type of work experience
   a. Clinical practice
   b. Academics
   c. Both
3. Work experience in Years.
4. How many paediatric patients do you treat on an average per day?
5. Do you prescribe antibiotics in the following clinical conditions?
   a. Pulpitis
      i. Reversible pulpitis Yes/No
      ii. Irreversible pulpitis(Acute/Chronic) Yes/No
   b. Localized intraoral swelling Yes/No
   c. Acute facial space infection Yes/No
   d. Draining sinus tract Yes/No
   e. Acute Dental trauma Yes/No
   f. Chronic Periodontitis (Incipient) Yes/No
   g. Periodontal Abscess Yes/No
   h. Pericoronitis Yes/No
   i. Simple extraction
      I. Mobile teeth Yes/No
      ii. Firm teeth Yes/no
   j. Open/Surgical Extraction Yes /No
   k. Dry socket(alveolar osteitis) Yes/No
   l. Periapical abscess (Acute/chronic) Yes/No
   m. Apical periodontitis Yes/No
6. What antibiotic do you most commonly prescribe?
7. What is the typical duration and course of the antibiotic that you prescribe?

QUESTIONNAIRE

8. Do you routinely calculate the paediatric dosages while prescribing antibiotics? Yes/No
9. Do you consider modifying the usual duration of the antibiotic course if there is no symptomatic improvement in the clinical condition ? Yes/No
10. Do you alter your prescription when there is an evidence of a mixed infection? Yes/No
    If yes, what would your prescription be?
11. Consider the following scenario :- A patient presents with an orofacial infection with a facial swelling and you have prescribed a course of antibiotics and given an appointment after the course is completed. The patient returns to you and there is not much improvement in the condition. What would you prefer to do in the following situation? Would you advise for a culture sensitivity test? Yes/No
12. What are the common side effects do you observe in children during the course of the antibiotic regimen?
    a)Rashes
    b)Nausea
    c)Diarrhoea
    d)If any other, Please specify
13. Are you aware of the current AAPD guidelines for antibiotic prophylaxis for medically compromised children and do you follow the same? Yes/No
14. Do you prescribe prophylactic antibiotics in cases of cardiovascular diseases such as:
    i. Congenital cardiac abnormalities Yes/No
    ii Infective Endocarditis Yes/No
    iii.Presence of prosthetic valve Yes/No
    iv.Presence of any coronary or vascular stents Yes/No
15. Do you prescribe prophylactic antibiotics in the following systemic conditions?
    i. Blood dyscrasias Yes/No
    ii. Immunodeficient states Yes/No
    iii. Diabetes Mellitus Yes/No
    iv. Systemic infections Yes/No
16. Are you aware of the growing antibiotic resistance in the current population? Yes/No
17. Are you aware of the term 'antibioma'? Yes/No
18. Do you follow up with your patient about completion the course of the antibiotic prescribed? Yes/No
19. Do you advise your patient to adhere to the dosage regimen and inform them the consequences of not doing so? Yes/No
20. Do you educate your patients on the ill-effects of self-medication with antibiotics? Yes/No

Statistical Analysis

The response data was downloaded from Google e-forms and emails were imported into Excel sheet of Microsoft Office Professional Plus 2019, 64-bit system and format. The descriptive statistics were used to calculate numbers and percentages for each category of information.

Results

The questionnaire was responded by 102 participants. Majority of the paediatric dentists who responded to the survey had a work experience between 5-15 years. About 47% of the participants treated between 5-10 patients a day. The data also depicted that about 47.5% of the total participants had clinical practice as work experience, 6.9% in academics and the rest of the participants had both clinical and academic work

experience (Fig 1). 57.8% of the paediatric dentists responded with a preference towards syrup/suspension as a medication of choice (Fig 2) for which Amoxicillin was the most commonly prescribed antibiotic (%) followed by a combination of Amoxicillin (%) and clavulanic acid (%) (Fig 3). The typical duration and course of antibiotic most prescribed was 5 days twice daily followed by 3 days twice daily (Fig 4).

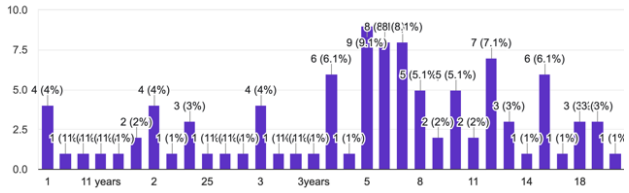

Fig. 1: The frequency of Pediatric dentists with different years of experience

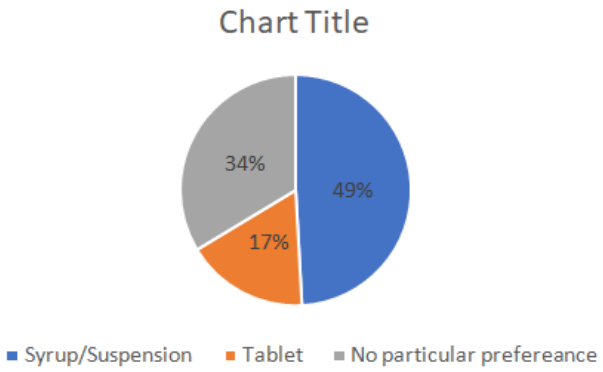

Fig. 2: Form of oral antibiotic medication prescribed by Pediatric dentists

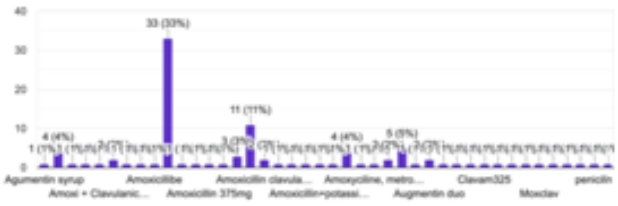

Fig. 3: The drug of choice by the dentists prescribed by dentists

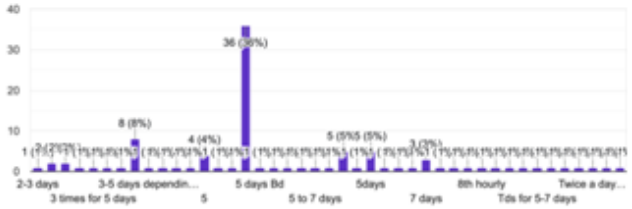

Fig. 4: The duration of antibiotic treatment prescribed by the dentists

About 66% of the respondents favoured calculation of the paediatric dosages before prescribing the antibiotics according to required strength of treatment (Fig 5).About 75% of paediatric dentists considered modifying the usual duration of the antibiotic course in case of no symptomatic improvement in the clinical condition (Fig 6). Further, 93% of the respondent dentists preferred altering the prescription in case of a mixed infection (Fig 7). Interestingly, about 61.4 % showed an inclination towards a culture sensitivity test in case a facial swelling doesn't subside after a course of conventional antibiotics (Fig 8).

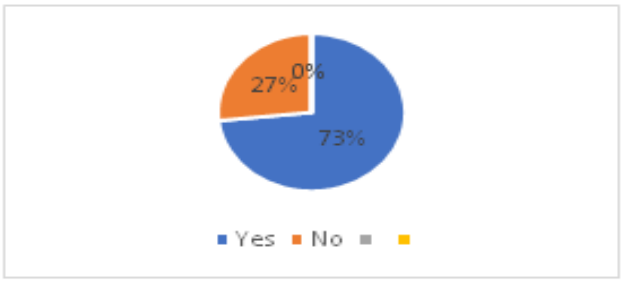

Fig. 5: The frequency of Pediatric dentists who favoured calculation of Pediatric dosages for maintaining prescribed strength.

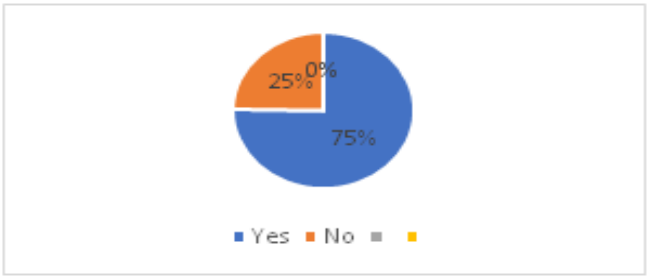

Fig. 6: The frequency of Pediatric dentists that modify duration of treatment

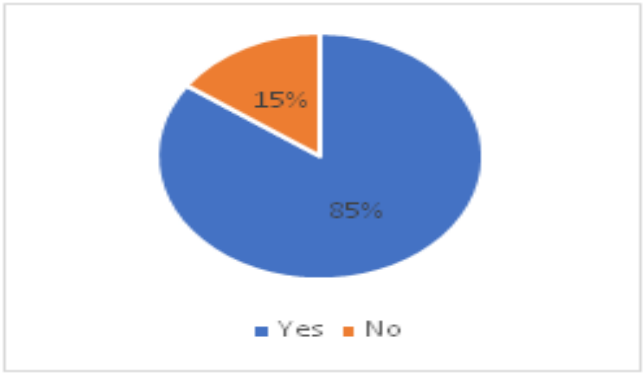

Fig. 7: The frequency of Pediatric dentists favouring alteration of prescription for mixed infections

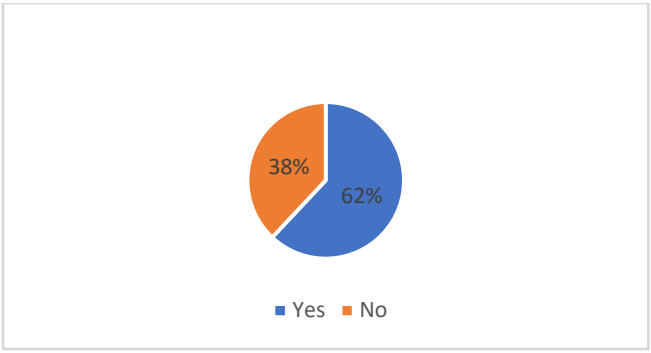

Fig. 8: The frequency of Pediatric dentists that incline towards culture sensitivity test

In respect of side effects of administered medicines, diarrhoea was the most common followed by nausea and gastric intolerance (Fig 9).

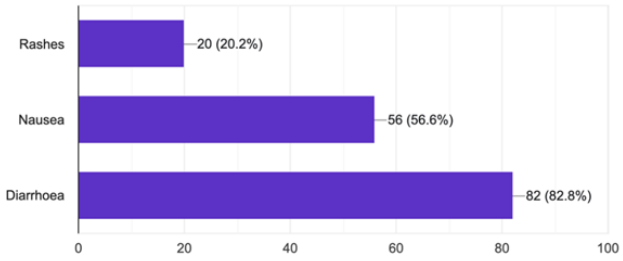

Fig. 9: Frequency of common side effects as observed by the paediatric dentists

During the course of treatment, prophylactic antibiotics were prescribed by the dentists to the maximum extent of 92.9% of in case of infective endocarditic followed by that in cases of presence of prosthetic valve (69.7%), congenital cardiac abnormalities (65.7%) and presence of coronary or vascular stents (49.5%) (Fig 10). Similarly, prophylactic antibiotics were prescribed in various frequencies as noticed in cases of systemic diseases such as immune deficient state (84.9%), systemic infections (77.4%), Diabetes melilitus (62.4%) and blood dyscrasias (31.2%) (Fig 11).

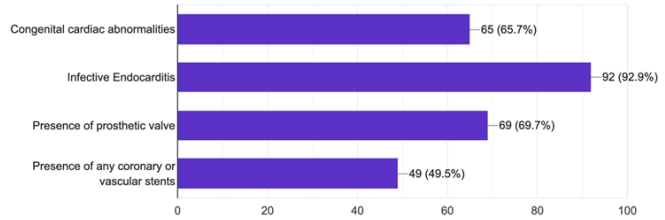

Fig. 10: Cardiovascular diseases where prophylactic antibiotics were prescribed.

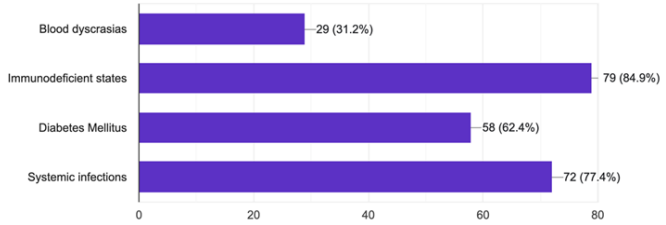

Fig. 11: Systemic diseases where prophylactic antibiotics were prescribed

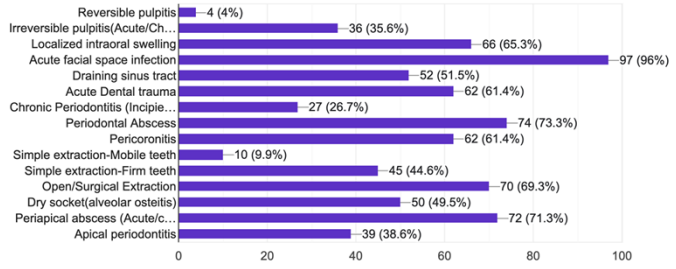

Fig. 12: Clinical Situations where antibiotics were prescribed by the Paediatric dentists

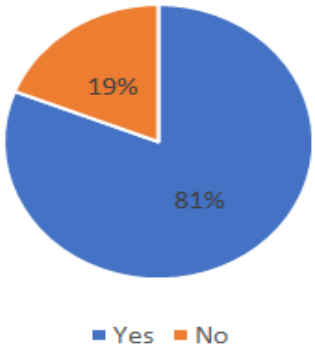

Fig. 13: The frequency of Paediatric dentists who are aware of the current AAPD guidelines for antibiotic prophylaxis for medically compromised children.

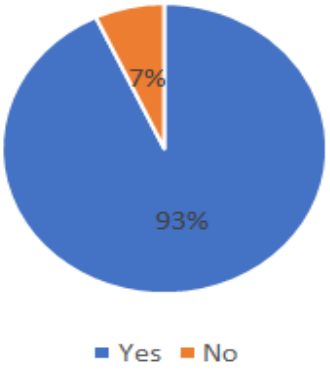

Fig. 14: The frequency of Paediatric dentists that are of the growing antibiotic resistance in the current population.

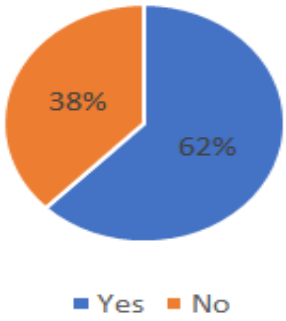

Fig.15: The frequency of Paediatric dentists aware of antibioma in the current population.

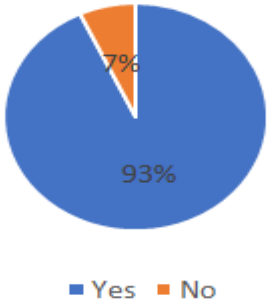

Fig.16: The frequency of Paediatric dentists that advice the patients to adhere to the dosage regimen.

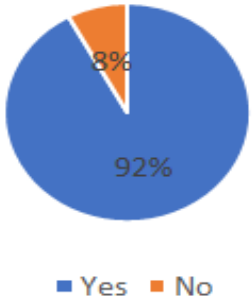

Fig. 17: The frequency of Paediatric dentists who educate the patients to regarding the ill effects of self-medicating with antibiotics.

Discussion

Antibiotic resistance is growing at absurd rates across the world endangering our capability to treat even frequently occurring infectious diseases exaggerated by antibiotic misuse and overuse as well as ineffective infection prevention and control. It was found thatthe prescription of antibiotics for drainage of an abscess related to a tooth has increased two-fold between 1998 and 2006.The present study showed a tendency of Paediatric dentists to overprescribe antibiotics in certain conditions like pulpitis(36%) draining sinus tract(65%), localized intraoral swelling(51%), periapicalabscess (71%), incipient chronic periodontitis, apical periodontitis(39%), dry socket and periodontal abscess(73%). These findings were in accordance with a

study conducted Mariam Mohsen Ally et al. 2021, Sivaraman SS et al and Sapna Konde et in 2017 where a similar antibiotic prescribing pattern was observed [6][7][8].

The proper treatment in these cases should be limited to endodontic treatment, with debridement of the root canal and analgesics. Usually, a correct diagnosis, together with effective root-canal treatment, will be sufficient to reduce the microbial load to allow healing. However, in this situation, again, a high percentage of dentists prescribe antibiotics. The mere presence of a sinus tract, in cases of asymptomatic necrotic pulp with chronic apical abscess, is not an indication for antibiotics because there is no systemic involvement [9]. The proper treatment of an uncomplicated abscess is effective drainage and removal of the cause. Although, Oral infections with fever, lymphadenopathy and trismus, or facial cellulitis with or without dysphagia, are serious diseases that should be treated by antibiotics because of the possibility of spread of infection via lymph and blood circulation.

Since most dental infections in children are bacterial in origin and only a limited number require antibiotics since most of these infections respond very well to operative procedures such as removing the source of infection and when antibiotics are needed, they are used as an adjunct to the operative therapy instead of being used as the only line of treatment.

Several studies indicate that inadequate understanding of the disease, uncertain diagnosis, time pressure, patient expectation, parental pressure, and refusal of operative treatment could be the influencing factors[7].Concerning prophylactic antibiotics for medically compromised children prescription, the present study showed the majority of paediatric dentists would prescribe antibiotics in cases of cardiovascular diseases and systemic conditions that don't require antibiotic prophylaxis according to the recent AAPD guidelines which would add to the burden of developing antibiotic resistance.[10]

It was identified that dentists often prescribed antibiotic prophylaxis to patients with a history of rheumatic heart disease, coronary artery bypass graft, mitral valve prolapse, Prosthetic valves and any recent history of myocardial infarction. However, AAPD guidelines no longer recommend antibiotic prophylaxis for patients with these conditions.[10]

Surveys suggest that Dentists often prescribe primary prophylaxis to healthy patients undergoing invasive oral health procedures such as surgical extractions, and endodontic procedures, which is worrisome because the evidence in support of antibiotic use for these procedures is minimal and inconsistent. While there is a possibility that oral microorganisms can infect distant tissues after oral practices, there is no proven evidence that this happens. Therefore, the fact of when and for which situations systemic prophylactic antibiotics are needed, is debatable. These findings were in accordance with several studies which indicate that inadequate understanding of the disease, uncertain diagnosis, time pressure, patient expectation, parental pressure, and refusal of operative treatment could be the influencing factors.

Regarding the prescription of antibiotics, it was seen that amoxicillin is the first-choice drug in the treatment of Odontogenic infections in paediatric patients followed by a combination of amoxicillin and clavulanic acid. Amoxicillin represents a synthetic improvement of the original penicillin molecule, being readily absorbed when it is taken with food and resistant to damage from stomach acid. Moreover, compared with penicillin, amoxicillin has a broader spectrum of effectiveness against the cell wall of Gram-negative bacteria, being

able to last a bit longer as a result of its resistance to stomach acid. A combination of Amoxicillin and clavulanic acid, because of its broad spectrum, low incidence of resistance, pharmacokinetic profile, tolerance and dosage, is one of the antibiotics recommended for the treatment of odontogenic infection [11].The broad spectrum of amoxicillin is possibly more than what is required for the treatment of apical periodontitis.

Metronidazole has been suggested as a supplemental medication for amoxicillin because of its excellent activity against anaerobes. In Europe and the Middle East, It is the second-choice antibiotic in the treatment of endodontic infections, and in Asia and Africa, the combination of amoxicillin and Metronidazole is the first-choice drug When a patient is allergic to penicillin, the first drug of choice varies throughout the world.[12]

In Spain and the United States, the first drug of choice is clindamycin an antibiotic active against oral anaerobes and facultative bacteria. However, high doses of clindamycin increase the probability of serious side effects, such as pseudo membranous colitis and neutropenia. On the other hand, in Belgium, the Middle East and Asia the first-choice antibiotic in penicillin-allergic patients is the macrolide erythromycin; the spectrum of activity of erythromycin against bacteria is comparable with that of penicillin.[12]. The study showed that the most of the participants follow up with the patient about completion of the course and advise them to adhere to the dosage regimen and educate them on the ill effects of self-medicating.

Majority of the paediatric dentists who responded to the questionnaire were aware of the growing antibiotic resistance which is imperative. There is an increasing use of the concept of anticipatory resistance where computational algorithms and experimental evolution could aid in predicting antimicrobial-resistance patterns, thus improving the design of antimicrobial drugs. Computationally predicting drug-resistance mutations early in the discovery phase would be an important breakthrough in antimicrobial development [13]. Hence, it is recommended that appropriate professional guidelines for antibiotic use should be specified to counter drug resistance along with continued dental education programs to update and revise the pattern of antibiotic prescription.

Study limitations

As with all Questionnaire studies, the data collected was self-reported by the participants and did not examine the actual prescription from the patient files. Hence reporting bias can be a concern as dentists' responses may not truly reflect their actual practice. In addition, non-response bias is another possible drawback of self-administered questionnaire research and may alter the actual results.

Conclusion

The present study showed a tendency to overprescribe and overuse antibiotics in certain dental conditions as well for prophylactic use in certain systemic conditions among the participants. Nearly all paediatric dentists were aware of antibiotic resistance, and the majority of them were also aware of the guidelines for the prescription and prophylactic use of antibiotics for systemic conditions. This study highlights the fact that there is a need to generate professional awareness regarding the risks of injudicious use of antibiotics and adherence to the AAPD guidelines for prescription of antibiotics among Paediatric dentists.

References

1. Global antimicrobial resistance and use surveillance system (GLASS) report 2022. Geneva: World

Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO

2. American Academy of Pediatric Dentistry. Caries-risk assessment and management for infants, children, and adolescents. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2023:301-7.
3. Sedgley CM, Lee EH, Martin MJ, et al. Antibiotic resistance gene transfer between Streptococcus gordonii and Enterococcus faecalis in root canals of teeth ex vivo. J Endod. 2008;34:570–574.
4. Caselli, E., Fabbri, C., D'Accolti, M. et al. Defining the oral microbiome by whole-genome sequencing and resistome analysis: the complexity of the healthy picture. BMC Microbiol **20**, 120 (2020). https://doi.org/10.1186/s12866-020-01801-y
5. Dar-Odeh, N. S., Abu-Hammad, O. A., Al-Omiri, M. K., Khraisat, A. S., & Shehabi, A. A. (2010). Antibiotic prescribing practices by dentists: a review. Therapeutics and clinical risk management, 6, 301–306. https://doi.org/10.2147/tcrm.s9736
6. Konde, Sapna; Jairam, Lalitha S; Peethambar, Preetha; Noojady, Sunil Raj; Kumar, Narayan Chandra. Antibiotic overusage and resistance: A cross-sectional survey among pediatric dentists. Journal of Indian Society of Pedodontics and Preventive Dentistry 34(2):p 145-151, Apr–Jun 2016. | DOI: 10.4103/0970-4388.180444
7. Aly, M.M., Elchaghaby, M.A. The prescription pattern and awareness about antibiotic prophylaxis and resistance among a group of Egyptian pediatric and general dentists: a cross sectional study. BMC Oral Health **21**, 322 (2021).
8. SirinogluCapan B, Duman C, Kalaoglu EE. Antibiotic prescribing practices for prophylaxis and therapy of oral/dental infections in pediatric patients - results of a cross-sectional study in Turkey. GMS Hyg Infect Control. 2023;18:Doc11. Published 2023 May 12. doi:10.3205/dgkh000437
9. Karamifar K, Tondari A, Saghiri MA. Endodontic Periapical Lesion: An Overview on the Etiology, Diagnosis and Current Treatment Modalities. EurEndod J. 2020;5(2):54-67. Published 2020 Jul 14. doi:10.14744/eej.2020.42714
10. American Academy of Pediatric Dentistry. Antibiotic prophylaxis for dental patients at risk for infection. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2023:542-8.
11. Akhavan BJ, Khanna NR, Vijhani P. Amoxicillin. [Updated 2023 Nov 17]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.Available from: https://www.ncbi.nlm.nih.gov/books/NBK482250/
12. Juan José Segura-Egea, Jenifer Martín-González, María del Carmen Jiménez-Sánchez, Isabel Crespo-Gallardo, Juan José Saúco-Márquez, Eugenio Velasco-Ortega,Worldwide pattern of antibiotic prescription in endodontic infections,International Dental Journal,Volume 67, Issue 4,2017,Pages 197-205,ISSN 0020-6539.
13. Charlebois DA. Quantitative systems-based prediction of antimicrobial resistance evolution. NPJ SystBiol Appl. 2023;9(1):40. Published 2023 Sep 7. doi:10.1038/s41540-023-00304-6