


ORIGINAL RESEARCH

The impact of clinical audit on antibiotic prescribing in dental practice at Taibah University Dental Hospital

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Abstract

There is evidence that antibiotics are sometimes prescribed inappropriately by dental practitioners, which can lead to undesirable outcomes. This study aimed to assess the impact of a clinical audit on antibiotic prescribing practices at Taibah University Dental Hospital in Madina, Saudi Arabia. The study retrospectively analyzed antibiotic-prescribing data for pediatric patients by dental interns and faculty members over a period of 8-months. The data collected revealed that inappropriate antibiotic prescription was prevalent initially, with a total of 119 antibiotic-prescriptions issued. After implementing an action plan that included the use of guidelines and educational sessions, a second cycle of the audit was conducted over a 4-month period. During the second cycle, the number of antibiotic prescriptions significantly decreased to 58, indicating a reduction of 48%. Across both cycles, amoxicillin emerged as the most frequently prescribed antibiotic, closely followed by Augmentin. Notably, pulpal diseases and peri-radical complications were consistently ranked as the conditions with the highest number of antibiotic prescriptions in both study periods. The results suggest that the clinical audit, along with the implementation of guidelines and educational sessions, had a positive impact on antibiotic prescribing practices at Taibah University Dental Hospital, leading to a significant reduction in inappropriate antibiotic prescriptions.

Keywords

Audit; Antibiotics; Pediatric dentistry; Prescription

1. Introduction

Antibiotics are used for eradication of bacterial infections either by killing or slowing down bacterial growth [1]. In dentistry, antibiotics are used for prophylactic and therapeutic purposes. The selection of the antibiotics depends on several factors such as microbiological, pharmacological and host factors. Dentists are estimated to account for 7% to 11% of all antibiotic prescriptions [2].

Throughout Saudi Arabia, studies showed that antibiotics are prescribed inappropriately in dental practice. In Jeddah, it has been observed that 65.9% of dentists did not adhere to the professional guidelines that are set for antibiotic-prescription [3]. In Eastern province, less than 30% were able to show acceptable level of clinical practice regarding antibiotic prescription [1]. In the North region of Saudi Arabia, 46.4% of dentists unnecessarily prescribed antibiotics for non-surgical-endodontic treatment [4]. Moreover, two nation-wide studies conducted in the year 2016 and 2017, showed that there was frequent prescribing of antibiotics in those conditions wherein it was not necessary [5, 6].

There are undesirable consequences due to overuse or misuse of antibiotics such as the development of bacterial resistance to antibiotics, and destruction of commensal flora of the

patient due to prolonged course of antibiotics [7]. Moreover, 0.02% to 0.04% of incidence rate of life threatening anaphylactic reactions to penicillin has been estimated [8].

Clinical audit is the process of systematically, and critically analyzing the quality of dental care, including procedures and processes used for diagnosis, intervention and treatment, resource use, outcome and quality of life as measured by professionals and patients [9]. An audit is recommended based on several factors such as: the issue to be addressed must be a common or significant issue; any changes resulting from the audit should benefit patients and improve the effectiveness. Also, the issue must be related to professional practice and the opportunity for improvement should be realistic [9]. Several audits have been conducted within the medical practice regarding antibiotic use [10–12]. However, the number of audits of antibiotic prescribing in dental practice is very limited. Two studies conducted in England found that the clinical audit can change the drug-prescribing-practice [9, 13]. Upon literature search, no study was conducted in Saudi Arabia utilizing audits of antibiotic prescribing in dentistry.

Thus, the aim of the present study was to evaluate the effectiveness of clinical audit on antibiotic prescribing in Taibah University dental hospital in Madina, Saudi Arabia.

2. Method

2.1 Study design

Retrospective-analysis of antibiotic prescribing data from patient records was carried out using electronic database (CS R4 electric kodak system). In May 2022, two faculty members of Taibah University college of Dentistry randomly reviewed antibiotic prescribing data, prepared by dental interns and faculty members for age group 5–16 years from September 2021 to April 2022. Fig. 1 (Flowchart) shows the number of patient-records and the antibiotic-prescriptions observed in first and the second cycles of the clinical audit.

A pro-forma was used to collect information anonymously for each occasion an antibiotic was prescribed. It included the antibiotic prescribed, dose, frequency, duration, the clinical condition and type of treatment (if carried out). Antibiotics prescribed for medically compromised patients were excluded from the data. After that, the data were reviewed, analyzed and areas of inappropriate prescribing were addressed. With these data, few potential areas for improvement were identified. Therefore, an action plan was prepared and aimed to empower dentists to prescribe antibiotic-medications appropriately so as to optimize the patient care.

Regarding dental interns, firstly, a memo was sent to the head of the program emphasizing the importance of following guidelines for antibiotic-prescription. Secondly, sharing of the result was done through a PowerPoint-presentation during Interns'-weekly-scientific-meetings. Lastly, instructions were given to all dental intern-supervisors to double check the prescriptions before signing it.

Regarding faculty members, memos were sent to all

head/chairman of divisions to share the results with the faculty members in their respective department meetings. Regarding the hospital policy, SDCEP (Scottish Dental Clinical Effectiveness Programme) Drug Prescribing for Dentistry guidance were downloaded in all clinics' desktops to facilitate the prescription [14]. Following data collection, anonymized feedback on the drug-prescribing activities was received. Weekly meetings with the Office of Clinics included dedicated sessions for updating clinical guidelines, reinforcing safety measures, and offering general reminders about antibiotic prescribing practices. The recorded one-hour continuing education presentation was distributed via email to all faculty members of the College of Dentistry, and made accessible to clinical providers and staff. To further promote awareness and adherence to guidelines, educational signs featuring "Centers for Disease control and prevention" (CDC) tip sheets titled "Seven Ways Dentists Can Act Against Antibiotic Resistance" [15] were strategically placed throughout the college and clinical-settings thus providing ongoing guidance to dentists regarding responsible use of antibiotics. In later conversations, clinical providers shared anecdotal insights indicating an increased awareness of proper antibiotic prescribing-practices following the implementation of the educational interventions.

The second cycle of audit was carried out from September 2022 to December 2022 with data being collected in the same way.

2.2 Data analysis

Data were analyzed using IBM SPSS (version 22) software (SPSS Inc, Chicago, IL, USA). Frequencies were used to

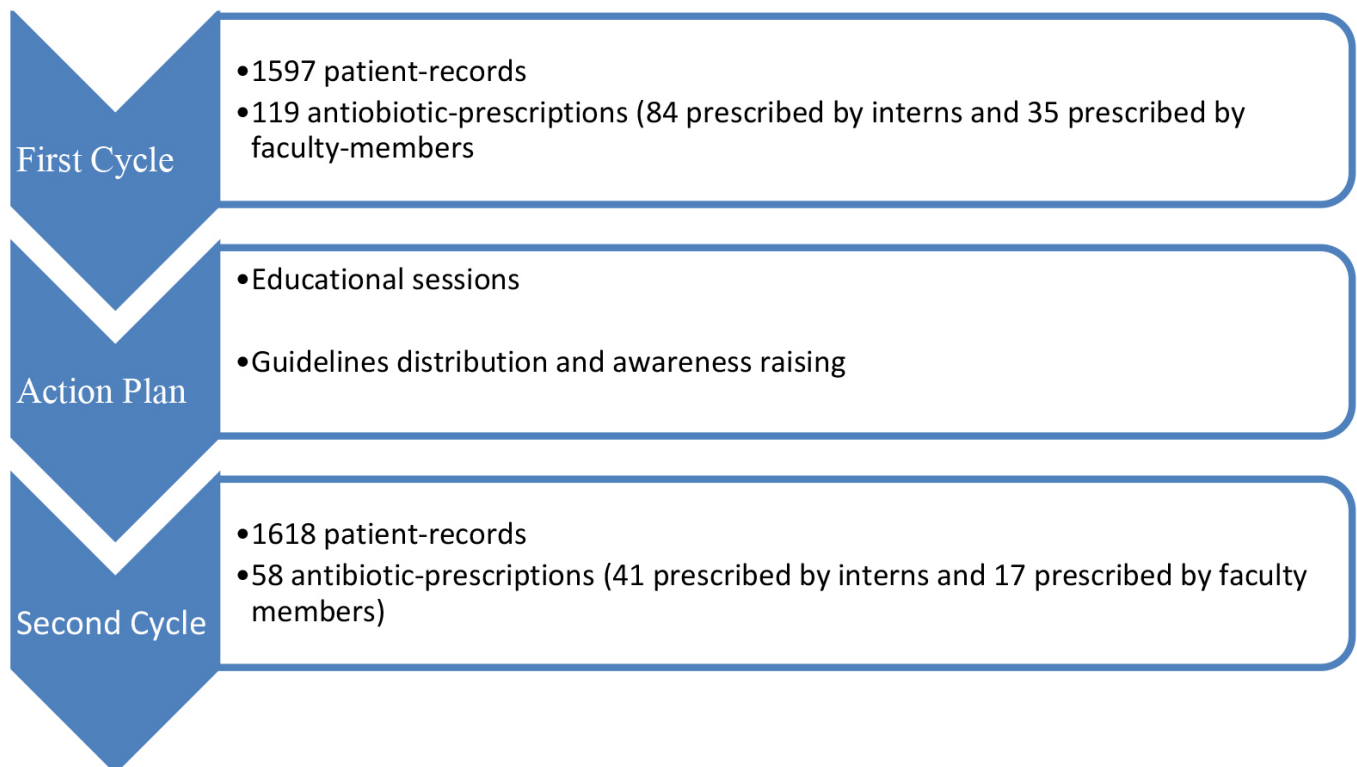


FIGURE 1. Flow chart shows the method that was followed in the study.

examine and describe the distribution of all the variables. The change in antibiotic-prescribing-practices between the first and second cycles was analysed and compared.

3. Results

In the current study, total number of participants was 31 (comprising of 15 females and 16 males); out of whom 25 were interns and 6 were faculty members. During the 1st cycle, a total of 1597 patient—records were collected and 119 antibiotic-prescriptions were issued. During the 2nd cycle, a total of 1618 patient—records were collected and 58 antibiotic-prescriptions were issued. The number of antibiotic prescriptions had been reduced significantly by 48%.

3.1 Antibiotics prescribed

Fig. 2 shows the five most frequent antibiotics prescribed during the two cycles of the audit. Over both cycles, amoxicillin was the most commonly prescribed antibiotic, being prescribed at 49 occasions in 1st cycle and 22 occasions in the 2nd cycle, followed by Augmentin which was prescribed in 31 occasions during the 1st cycle and in 18 occasions during the 2nd cycle. Clindamycin was the least prescribed antibiotic in both the 1st and 2nd cycles, being prescribed in 4 occasions and 3 occasions, respectively.

3.2 Reasons for prescribing

Table 1 shows the clinical conditions recorded by the dentists for whom antibiotics had been prescribed, along with the number of times (frequency), the antibiotic-prescriptions were issued during 1st and 2nd cycles of audit. Pulpal diseases and peri-radicular complications represented the conditions with the highest number for antibiotic prescriptions in both cycles, wherein 25 prescriptions in the 1st cycle and 11 prescriptions in the 2nd cycle was observed. Acute periodontal abscess represented the second most common condition for antibiotic prescriptions (23 prescriptions) during the 1st cycle, while pericoronitis represented the second most common condition

for antibiotic prescriptions (11 prescriptions) during the 2nd cycle. Periodontitis was the third most common condition for antibiotic prescriptions (18 prescriptions) during the 1st cycle, while acute periodontal abscess and pericoronitis were the third most common conditions for antibiotic prescriptions (9 prescriptions) during the 2nd cycle. In both the cycles, tooth extraction represented the condition with the least number for antibiotic prescriptions, wherein 3 prescriptions in the 1st cycle and 1 prescription in the 2nd cycle, was noticed.

4. Discussion

Appropriate prescribing of antibiotic is crucial for the effective treatment of patients, as well as the reduction of antibiotic resistance. These can be achieved through improved prescribing practices by all health care practitioners.

Managing and treating infectious diseases has become quite difficult as a result of misuse of prescribing antibiotics and thus increasing the level of bacterial resistance [16]. Antibiotics-over-prescription in pediatric dentistry have been related to multiple factors including improper diagnosis, parental pressure, and lack of dentists' knowledge [17]. Low level of dentists' awareness and inadequate compliance with the European Academy of pediatric dentistry and American academy of pediatric dentistry (EAPD and AAPD) guidelines would also contribute to antibiotic misuse [18]. This could explain the high number of prescriptions observed during the first audit in the current study. Significant decrease in the number of prescribed antibiotics was noticed after auditing and increasing the awareness of dental interns and faculty members towards the clinical guidelines of antimicrobial prescription.

The present study revealed that pulpal diseases and peri-radicular infections were the most common reasons behind antibiotic prescription. This observation was similar to another study published in 2021 by Aly and Elchagha [19]. In addition, localized abscesses such as pericoronitis were also a common reason for antibiotic prescriptions found in the current study and previous reports as well [20]. According to the AAPD guidelines, antibiotic therapy is not indicated in the majority

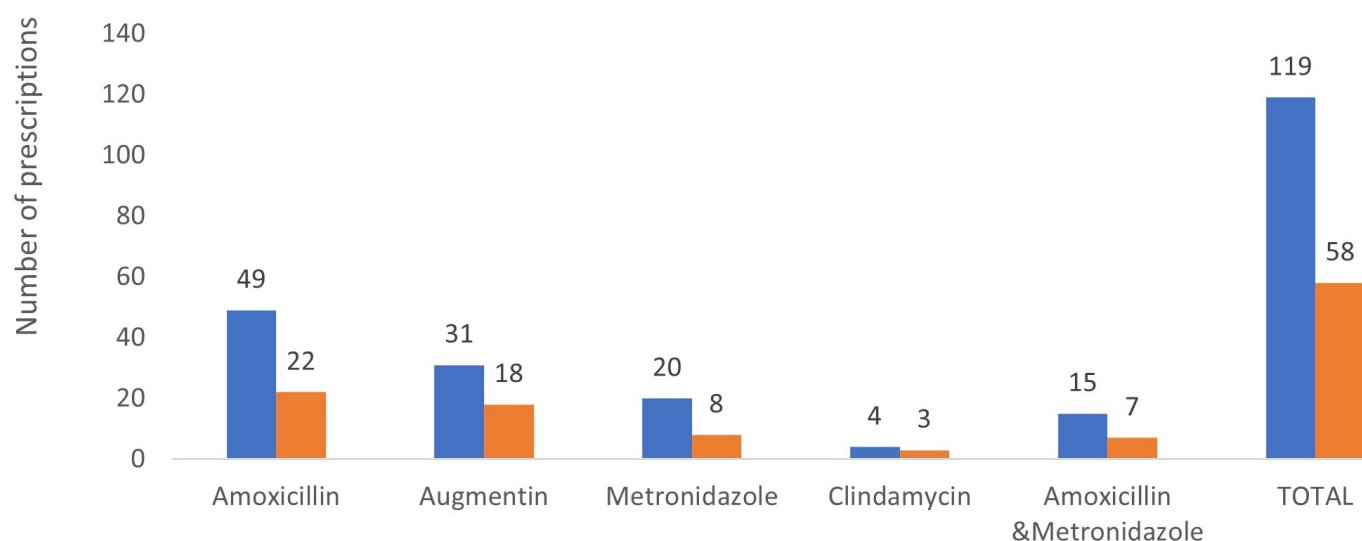


FIGURE 2. Number of antibiotic prescriptions during the 1st and 2nd cycles of audit.

TABLE 1. Conditions that led for antibiotic prescription during the two cycles of audit.

Clinical condition	Number of Prescriptions 1st cycle (Sep 2021–Apr 2022)	Number of Prescriptions 2nd cycle (Sep 2022–Dec 2022)
Endodontic treatment and procedures	8	4
Tooth extraction	3	1
Gingivitis	4	1
Acute periodontal abscess	23	9
Pulpal diseases and peri-radicular complications	25	11
Periodontitis	16	9
Pericoronitis	18	10
Not mentioned	7	4
Total	104	51
Total number of patients	1597	1618

of pulpal diseases and localized dental infections when it is confined to the pulpal or the immediate surrounding tissues. Dental treatment such as pulpotomy, pulpectomy or extraction would be more effective in such cases. However, antibiotic prescription should only be considered when there are signs of systemic manifestations such as facial swelling and fever [21]. Findings from the current study, as well as previous reports, clearly indicate that the compliance of dentists with the current clinical guidelines is still inadequate.

The present study focused on dental interns since they are fresh graduates who are getting ready to start their career. In addition, faculty members were included to assess and update their awareness regarding the latest guidelines and the new policies of the dental hospital. Following the guidelines facilitates set-standards in audit, and it has been shown that guidelines improved medicine-prescribing-practices in medical practice [22].

In the present study, “Drug Prescribing for Dentistry guidance” (3rd edition) was given to the dental interns and faculty members [14]. It was based on British National Formulary (BNF 70) and BNF for Children (BNFC 2015–16) produced by SDCEP which operates within National Health service (NHS) Education for Scotland [23, 24].

Studies showed that guidelines alone are of little value but can be much more effective if provided in conjunction with educational components [25, 26]. The current study revealed that, using guidelines in conjunction with educational component along with feedback, was significantly effective in reducing inappropriate prescription of antibiotics. The findings of this study were similar to those reported in a study conducted in England, in terms of the reduction in the overall number of antibiotics prescribed to the patients [9, 13]. The overall number of antibiotics prescribed was reduced by almost one half. There was a significant reduction in the number of prescriptions for pulpal diseases, periodontitis, pericoronitis, and abscess cases. These prescriptions were considered inappropriate since the guidelines recommend prescribing of antibiotics in cases of systemic manifestations only [14].

Gingivitis is the inflammation localized to the gingiva

and initiated by the accumulation of a microbial biofilm on teeth [27]. So, it is inappropriate if antibiotics are prescribed even for gingivitis because antibiotic-prescription to treat the causative factor is not recommended [14, 28]; instead scaling and strict oral hygiene instructions are the best modalities to improve such conditions [28, 29]. Moreover, it was necessary to illustrate this valid point during the educational sessions and emphasize on the importance of following the guidelines and to be thorough with the indications of prescribing antibiotics, mentioned in the set-guidelines.

The number of antibiotics prescribed for extraction of impacted teeth was much higher than the simple extractions. This is likely because extraction of impacted teeth is complex procedure involving bone removal. Some studies have reported that antibiotic-prescription after extractions significantly reduce postoperative-consequences [30, 31]. Based on result of our study, the most frequently prescribed antibiotic was Amoxicillin. Amoxicillin is a penicillin antibiotic that is effective against Gram-negative bacilli [32, 33]. Penicillin is considered the first-line antibiotic-therapy and as the gold standard for the treatment of odontogenic infections which is attributed to the number of reasons such as low incidence of side effects, cost-effectiveness and effective antimicrobial activity [34, 35].

Metronidazole was also considered in this study in managing dental infections after amoxicillin and Augmentin. It is very effective against anaerobic bacteria or patients who are allergic to penicillin group. This was proved and confirmed by American Academy of Paediatric Dentistry [36].

Despite the awareness of dental interns and faculty members of the clinical guidelines regarding antimicrobial prescribing, overuse of this medication was observed. This could be as a result of lack of experience among general dentists.

However, despite significant reductions in prescriptions for those clinical conditions wherein it was not mandatory to be prescribed as recommended by the current guidelines, a reasonable number of such prescriptions still recur. Accordingly, a third cycle should be considered to fulfil the standard. Thus, a second meeting with the dental interns could be held to

discuss the new results and reinforce education, which will ensure further required improvement.

5. Limitations of the study

The interpretation of audit results should consider certain limitations. It is important to acknowledge that not all interns who were involved in the initial cycle of the study could participate in the second cycle, as some of the interns were recruited for new jobs elsewhere causing their drop-out in the second cycle of the study. This had a potential to introduce variability in the data because of changes in the composition of the participant-group between cycles.

6. Conclusions

Within the limitations of the study, it was concluded that the clinical audits in conjunction with raising awareness and imparting the relevant educational-sessions, significantly reduced the inappropriate prescription of antibiotics among interns and dental practitioners. In the first cycle of the audit, it was observed that a total of 119 antibiotic-prescriptions were prescribed while as, in the second cycle of audit, the total number of antibiotics prescriptions was 58, showing a significant reduction of 48%.

7. Future recommendations

A collaborative approach to tackle the important issue of misuse of antibiotics, should be used. Though WHO (World Health Organization) has taken several initiatives regarding this problem but more needs to be done as far as its practical solution is concerned. The programs of awareness-raising should involve many sections of the population such as parents, school teachers, dentists, dental students, youth and the elderly community members so as to address the consequences of mis-use and over-use of antibiotics; as sometimes the dentists prescribe so under the pressure of parents of children/patients. The medical health professionals need to give counseling to patients as well as dentists regarding the adverse effects of over-use of antibiotics. As far as dental professionals, practicing pediatric dentists and all other dental specialists and dental students are concerned; they need to update and acquaint themselves with the latest guidelines set by the concerned authorities and organizations such as WHO, AAPD by way of attending Conferences (National/International) and CDE (Continuing Dental Education) programs. Making use of the right knowledge in the right direction by the dentists would make a big difference. Conducting more collaborative and longitudinal research would be quite beneficial. More frequent clinical audits should also be conducted by respective experts so as to evaluate the implications of the set-guidelines in dentistry.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

SFA—study concept, study design, approval of final version of manuscript; SAA—critical evaluation, result interpretation, final approval of manuscript; AAA—literature review, data acquisition, approval of final version of manuscript; YA—drafting of manuscript, data acquisition, final approval of manuscript; NSA—critical evaluation of initial draft of manuscript, result-interpretation and data presentation, final approval of manuscript; TSA—statistical analysis, revision of manuscript, final approval of manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval for the study was obtained from Institutional Review Board (IRB), College of Dentistry, Taibah University (TUCDREC/150523/SFAIqadi) and was conducted in accordance with the guidelines of the Declaration of Helsinki (2000). The consent form was signed by mother of each child who participated in the study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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