Objectives: Inappropriate prescribing of antibiotics by healthcare professionals is a worldwide concern. The purpose of this study was to determine the pattern of antibiotic prescription among oral healthcare providers in India.

Methods: A one-page questionnaire was sent to 1600 oral healthcare practitioners registered under the Indian Dental Association by using multistage sampling; 552 (34.5%) responded to the survey. The data were analysed using the \( \chi^2 \) test and multiple logistic regression analysis.

Results: Of 552 questionnaire respondents, 405 (73.4%) chose amoxicillin in non-allergic patients, alone [279 (50.5%)] or associated with clavulanic acid [126 (22.8%)]. The average duration of antibiotic therapy was 4.26 ± 1.26 days. The drug of first choice for patients with an allergy to penicillin was erythromycin [242 (43.8%) of respondents]. A majority prescribed antibiotics for irreversible pulpitis and acute apical periodontitis [395 (71.6%)] and necrotic pulp, acute apical periodontitis and no swelling [326 (59.1%)]. Five hundred and ten (92.4%) of the oral healthcare providers overprescribed antibiotics.

Conclusions: Oral healthcare providers in India are overprescribing, which could be a major contributor to the world problem of antimicrobial resistance. As there is overprescription of antibiotics by Indian oral healthcare providers, there is an urgent need to raise public and professional awareness regarding the risks of antibiotic use.

Keywords: endodontic infections, general practitioners, India

Introduction

Dental practitioners regularly prescribe antibiotics for therapeutic or prophylactic purposes to manage oral and dental infections. Odontogenic infections, especially endodontic infections, are polymicrobial. Thus, antibiotics, with analgesics, account for the vast majority of medicines prescribed by dentists. In 2007, dentist prescriptions of antibiotics accounted for 8% of the total national antibiotic consumption in Norway.1

The inappropriate and excessive use of antibiotics is a major factor in the emergence of antibiotic resistance.6 Dentistry’s contributions to the problem of antibiotic resistance can be substantial because dentists prescribe ~10% of all common antibiotics.3 There are other issues too, such as possible adverse events and additional costs of prescribing. Consequently, surveillance of antimicrobial resistance, monitoring of antibiotic usage and attempts to improve prescribing attitudes have become crucial.1 Yingling et al.4 determined the prescribing habits of the active members of the American Association of Endodontists (AAE) with regard to antibiotics, concluding that there were still many who were prescribing antibiotics inappropriately. However, in India no study has analysed prescribing habits with regard to antibiotics.

The aim of this study was to determine the pattern of antibiotic prescription among oral healthcare providers in India.

Methods

This was a descriptive cross-sectional study performed among oral healthcare practitioners in India registered under the Indian Dental Association (IDA). With a multistage sample, four state branches of IDA, with 32 local branches, were approached for the study. These practitioners (1600) included those holding the Bachelor of Dental Surgery (BDS) and Master of Dental Surgery (MDS) degrees who regularly engage in root canal treatment practice. They were sent a letter describing the survey, definitions of antimicrobials, chemotherapeutics and antibiotics, and requesting participation as well as granting anonymity. Enclosed with the letter was a questionnaire (available as Supplementary data at JAC Online) with mainly closed answers regarding demographics and individual antibiotic prescribing habits. One reminder was forwarded to participants who did not respond within a deadline. This study was approved by the institutional review.
Antibiotic prescription pattern among Indian practitioners

Results

Of the 1600 dental practitioners, 552 (response rate 34.5%) completed the form, including 55.3% males and 44.7% females with a mean age of 31.58 ± 7.2 years. There were 46.7% BDS and 53.3% MDS practitioners. The majority of respondents were in part-time endodontic practice, and only 13.1% declared themselves to be in full-time endodontic practice. However, 86.9% of the respondents dedicated more than half of their dental practice to endodontics. There was no significant difference amongst respondents with regard to age, gender, academic degree and time dedicated to endodontics.

Most of the respondents (73.4%) chose amoxicillin in non-allergic patients (alone (50.5%) or associated with clavulanic acid (22.8%). Amoxicillin was prescribed as the first-choice antibiotic by 39.4% of respondents, which is appropriate for oral infection, whereas 19.3%, 18.7% and 5.3% selected amoxicillin/clavulanic acid, ofloxacin + ornidazole and ciprofloxacin + tinidazole, respectively, which are not necessary for oral health practice. The average duration of antibiotic therapy was 4.26 ± 1.26 days.

**Table 1.** Situations in which antibiotics were prescribed

<table>
<thead>
<tr>
<th>No.</th>
<th>Situation</th>
<th>Antibiotics prescribed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IP; moderate/severe pre-operative symptoms</td>
<td>37.6</td>
</tr>
<tr>
<td>2</td>
<td>IP with AAP; moderate/severe pre-operative symptoms</td>
<td>71.6</td>
</tr>
<tr>
<td>3</td>
<td>NP with CAP; no swelling; no/mild pre-operative symptoms</td>
<td>38.2</td>
</tr>
<tr>
<td>4</td>
<td>NP with AAP; no swelling; moderate/severe pre-operative symptoms</td>
<td>59.1</td>
</tr>
<tr>
<td>5</td>
<td>NP with CAP; sinus tract present; no/mild pre-operative symptoms</td>
<td>46.9</td>
</tr>
<tr>
<td>6</td>
<td>NP with AAP; swelling present; moderate/severe pre-operative symptoms</td>
<td>90.2</td>
</tr>
</tbody>
</table>

AAP, acute apical periodontitis; CAP, chronic apical periodontitis; IP, irreversible pulpitis; NP, necrotic pulp.

**Table 2.** Multivariate logistic regression analysis of the influence of the independent variables (gender (male = 1, female = 2), age (1 = 25–35 years, 2 = 36–45 years, 3 = >45 years) and academic degree (1 = BDS, 2 = MDS)) on the dependent variable antibiotic prescription in the fifth clinical situation (0 = no, 1 = yes)

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>B</th>
<th>P</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.752</td>
<td>&lt;0.001</td>
<td>2.121</td>
<td>1.485–3.030</td>
</tr>
<tr>
<td>Age</td>
<td>0.030</td>
<td>0.837</td>
<td>1.030</td>
<td>0.776–1.366</td>
</tr>
<tr>
<td>Academic degree</td>
<td>0.232</td>
<td>0.710</td>
<td>1.261</td>
<td>0.371–4.287</td>
</tr>
</tbody>
</table>

The drug of first choice for patients with an allergy to penicillin was erythromycin (43.8%), followed by clindamycin (17.5%), azithromycin (15.6%) and metronidazole (14.9%).

Table 1 lists the percentage of respondents who prescribed antibiotics for various pulpal and periapical diagnoses.

To further study the possible association between these factors and the pattern of antibiotic prescription, multivariate logistic regression analysis (Table 2) was carried out with gender, age and academic degree as independent dichotomized variables and the dependent variable antibiotic prescription in the fifth clinical situation (Table 1). The analysis suggested that the prescription of antibiotics was significantly higher by male practitioners.

Discussion

In our survey, the questions and the six endodontic treatment situations proposed were based on those in previous surveys developed in the USA5,6 and Spain.5,6 The overall response rate was 34.5%, which was similar to the rates in other published surveys.7,8 Endodontic infections typically have a rapid onset and short duration, particularly if the cause is treated or eliminated.9 Prolonged courses of antibiotics destroy the commensal flora and abolish colonization resistance.10,11 The prescribing of systemic antibiotics must therefore be justifiable.

Amoxicillin’s broad spectrum is more than is required for endodontic needs, and its use in a healthy individual may contribute to the global antibiotic resistance problem.12 In Spain, the leading antibiotic treatment prescribed in 2007 was amoxicillin plus clavulanic acid, followed by amoxicillin alone.13 Amoxicillin is also the principal antibiotic prescribed in dental clinics in other European countries.14

In contrast, in the USA amoxicillin was prescribed only by 27.5% of members of the AAE.4,15 In this study, the second most frequently prescribed antibiotic for non-penicillin-allergic patients was ofloxacin + ornidazole (18.7%). In contrast, in previous reports metronidazole and clindamycin were the other most prescribed drugs in non-penicillin-allergic patients.5,6

The drug of first choice in patients with an allergy to penicillins was erythromycin (43.8%) in India in the present study. In contrast, clindamycin was the most prescribed drug in penicillin-allergic patients in the USA (21.6%12 and 57.03%4) and Spain (63.2%5 and 65.4%).6 Other antibiotics prescribed for patients with an allergy to penicillins were clindamycin (17.5%), azithromycin (15.6%) and metronidazole (14.9%). Clindamycin is a good choice if the patient is allergic to penicillin, although clindamycin has a low, but serious, risk of pseudomembranous colitis.16 Azithromycin has no role in oral infection because about 82% of oral streptococci develop resistance to macrolides after a single course.17

Metronidazole, prescribed in Spain, the USA and India, is very effective against obligate anaerobes, but not against facultative anaerobic bacteria. Therefore, it is necessary for it to be used in conjunction with other agents.

Table 1 lists the percentage of respondents who prescribed antibiotics for various pulpal and periapical diagnoses. In the first and second situations, pulps are still vital. There is no infection or signs of systemic involvement. Antibiotics are not indicated in either situation. These findings are different from those found by various authors.4–6,15

In the third situation there is no indication for antibiotic use and treatment should be limited to non-surgical root canal treatment.
(NSRCT). In this survey, 38.2% of practitioners prescribed antibiotics, similar to the finding of Segura-Egea et al. and 25% higher than the percentage found for Spanish endodontists by Rodriguez-Núñez et al. In previous surveys in the USA higher percentages have been reported, showing that this problem is widespread.

The proper treatment for the fourth category is debridement of the root canal space and analgesics. The present survey found that 59.1% of oral healthcare providers prescribed antibiotics in the fourth category, which fits in the same range (30%–71%) as previous studies. This again shows over-usage of antibiotics.

Interestingly, 46.9% of respondents still prescribed antibiotics for asymptomatic cases in the fifth scenario. This is almost four times the value reported by Yingling et al. (11.9%), greater than that reported by Whitten et al. (29.2%) and less than that reported by Segura-Egea et al. (60%). The treatment should consist of NSRCT with analgesics if needed for pain and effective drainage for uncomplicated abscesses, but no antibiotics. However, if the patient is medically compromised and the sinus tract does not close within a few weeks or the patient experiences a flare up with systemic involvement, then antibiotics would be indicated.

In the last situation, the rate of prescribing antibiotics in previous studies ranged from 87% to 99%. Our survey found that 59.1% of dental practitioners must have a thorough understanding of the clinical indications for antibiotic prescription in order to prevent the misuse or overuse of these medicaments.

Conclusions
Oral healthcare providers in India are overprescribing, which could be a major contributor to the worldwide problem of antimicrobial resistance. There is an urgent need to raise public and professional awareness regarding the risks of antibiotic use in dentistry. Ignoring these problems will undoubtedly result in an increase in the incidence of untreatable dental infections and, most importantly, the death of patients from dental disease in the future.

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Transparency declarations
None to declare.

Supplementary data
The questionnaire is available as Supplementary data at JAC Online (http://jac.oxfordjournals.org/).

References