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Antibiotic Resistance – A Concern for Dentists?

Dr. Karibasappa G.N[1], Dr.Sujatha A[2]
Associate Professor, Department of Public Health Dentistry, ACPM Dental College,Dhule,Maharashtra,India.2) Sr .Lecturer, Department of Public Health Dentistry, Sathyabama Dental College and Hospital, Chennai-600012, Tamil Nadu, India

Abstract: ***Background: Antibiotic*** *overuse and misuse among dentists was found to be substantial. Exploration of scientific literature revealed very limited studies in India assessing the antibiotic prescription pattern among dentists.*

Objective*: The present survey was carried to assess the antibiotic prescription pattern, awareness on antibiotic resistance and measures taken to combat antibiotic resistance among dentists at Dhule city of Maharashtra.*

Materials and methods:

A self-designed questionnaire was prepared in English to collect the demographic data and information regarding the prescription pattern of antibiotics among dentists at Dhule. The questionnaire was pre-tested for feasibility and reliability. Crohn Bach's alpha value for reliability was found to be 0.6. Questionnaire was distributed in person to all the dentists. Response rate was 100%. Statistical analysis: chi-square test

Results:

Majority of dentists were found to prescribe antibiotics for managing oral diseases except for orthodontic treatment. When comparisons were made between BDS and MDS graduates, majority of the questions were found to be not significant except for periodontal pockets (p=0.02), tooth fracture (p=0.03), dental caries with pulpitis (p<0.001), dental caries with apical periodontitis (p<0.001) and periapical abscess (p=0.02)

Conclusions:

Dental diseases are predominantly because of local factors; Antibiotics should be used only as adjuncts even when there is a real need; never the first line of treatment modality. Public needs to be educated at mass level against self-medication with antibiotics, which will help us in curbing antibiotic resistance to a greater extent.

Key words: *systemic antibiotics, dentistry, antibiotic resistance*

I. Introduction:

The mortality rate due to infectious diseases was high ages ago. Millions and millions of lives were saved owing to the discovery of antibiotics. In fact, antibiotics can be called as "Life-saving drugs". However, antibiotic prescribing may be associated with unfavorable side effects ranging from gastrointestinal disturbances to fatal anaphylactic shock.[1]Additionally, inappropriate, indiscriminate and irrational use of antibiotics has led to the development of antibiotic resistance. Even more alarming is the rate at which bacteria develop resistance; micro organisms exhibiting resistance to new drugs often are isolated soon after the drugs have been introduced.[2] This growing problem has contributed significantly to the morbidity and mortality of infectious diseases, with death rates for communicable diseases rising again.[3, 4] Moreover, antibiotics are societal drugs that affect microbial resistance not only in the person taking drug but also everyone else, because resistance genes are easily passed via personal contacts, fomites, human and animal refuse.[5]World Health Organization has recognized this growing global problem, announced the theme for the year 2011 as "Antibiotic resistance: No action today, No cure tomorrow" and has pressed for an international action. Scientific literature evidence suggests that dentists are prescribing around 7-11% of common antibiotics (beta lactams, macrolides, tetracycline, clindamycin, metronidazole).[6] Dentistry's contribution to antibiotic resistance is unknown. Exploration of scientific literature revealed very limited studies in India assessing the antibiotic prescription pattern among dentists. This provided an impetus to conduct this survey to assess and understand the antibiotic prescribing practices among the dentists. The aim of the survey was to assess the antibiotic prescription pattern for common oral conditions and routine dental treatment, awareness on antibiotic resistance and measures taken to combat antibiotic resistance among dentists at Dhule city of Maharashtra. The present survey was planned with a hypothesis that there is inappropriate and injudicious antibiotic prescription among dentists. There is a difference in the antibiotic prescription pattern among Bachelor in dental surgery (BDS) graduates and Masters in Dental Surgery (MDS) graduates.

II. Materials and methods:

The present study is a cross-sectional survey. Ethical clearance was obtained from the Institutional Review Board. Permission was obtained from the concerned authorities to conduct the present survey. A self-

designed questionnaire (Table no: 1) was prepared in English to collect the demographic data and information regarding the prescription pattern of antibiotics among dentists at Dhule. The questionnaire contained close-ended and open-ended questions as well to make it flexible for the participants. The questions were pertaining to the following: antibiotics prescription for the most common oral conditions for their patients (yes/no), commonly prescribed antibiotic(s), interventions done during certain clinical situations, awareness on antibiotic resistance and measures taken to combat antibiotic resistance. The questionnaire was pre-tested for feasibility and reliability. Crohn Bach's alpha value for reliability was found to be 0.6.

A list containing the names of all dentists in Dhule city was obtained from the local Indian Dental Association office. Since there were only 82 registered dentists available in Dhule city, sampling procedure was not done. Moreover, it was feasible to include all the dentists in the present survey. Written informed consent was obtained from the participants. Questionnaire was distributed in person to all the dentists in Dhule city. Response rate was 100%.

The data obtained was compiled, tabulated and subjected to statistical analysis using SPSS (Statistical Package for Social Science) version 16. Chi-square test was used to test the difference in proportion according to their qualification. The level of significance (α) was fixed at 5%

III. Results:

Majority of the participants (81.7%) were 25-40 years old. Fifty four percent were males and 46 % were females. While 32.9% were MDS graduates, majority were BDS graduates in the present survey. The responses given by the participants regarding antibiotic prescription for commonly encountered oral conditions and routine dental treatment are compiled and presented in Table No.1. When comparisons were made between BDS and MDS graduates, majority of the questions were found to be not significant except for periodontal pockets ($p=0.02$), tooth fracture ($p=0.03$), dental caries with pulpitis ($p<0.001$), dental caries with apical periodontitis ($p<0.001$) and periapical abscess ($p=0.02$) (Table 3)

It was found that majority of dentists prescribed amoxicillin (79.3%) as their first choice of antibiotic followed by ofloxacin with ornidazole (9.8%), cephalexin (8.5%) and amoxicillin with clavulinic acid (2.4%). Accordingly, their prescriptions change when there is an evidence of anaerobic infection. To treat anaerobic infections, combination of amoxicillin and clavulinic acid with metronidazole (59.8%), followed by ofloxacin (25.6%), ornidazole (9.8%) and cephalexin (2.4%) was prescribed. Most of the dentists (82.9%) preferred an incision and drainage for dentoalveolar abscess cases under antibiotic coverage. Only 4.9% dentists carry out incision and drainage without an antibiotic cover. The remaining participants (12.2%) prescribe antibiotics on the first visit and schedule a next appointment for their patients. When poor response was encountered with a particular antibiotic, samples were sent for an antibiotic sensitivity test by majority of dentists (61%). Around 32.9% of dentists prescribe another course of antibiotics without understanding the sensitivity of micro-organisms.

Sixty five percent of dentists opined that antibiotics were absolutely necessary for managing oral diseases. Around 90% of dentists were aware of the term "Antibiotic resistance" and knew that injudicious prescription pattern among health professionals and self-medication with antibiotics inappropriately were contributing to the emergence of antibiotic resistance. Exactly 50% of dentists have already encountered few cases of antibiotic resistance in their dental practice. The first and foremost step taken by dentists to combat antibiotic resistance is proper diagnosis (65.3%) and patient education (31.9%). A very few dentists feel use of narrow-spectrum antibiotics (2.8%) may also help in combating antibiotic resistance.

TABLE 1: QUESTIONNAIRE USED FOR THE SURVEY

1.	Do you routinely prescribe antibiotics in the following situations?				
	a.	Tooth sensitivity			Yes/No
	b.	Periodontal pockets – shallow/deep/Both		Yes/No	
	c.	Halitosis			Yes/No
	d.	Tooth fracture		Yes/No	
	e.	Dental caries		Yes/No	
	f.	Dental caries with pulpitis	Yes/No		
	g.	Dental caries with apical periodontitis	Yes/No		
	h.	Periapical abscess			Yes/No
	i.	Dentoalveolar abscess		Yes/No	
	j.	Orofacial infections with signs of systemic involvement	Yes/No		
	k.	Asymptomatic impacted tooth		Yes/No	
	l.	Pericoronitis		Yes/No	
	m.	Pericoronal abscess		Yes/No	
	n.	Simple extraction			Yes/No
	o.	Extraction by open method	Yes/No		
	p.	Surgical removal of impacted tooth	Yes/No		
	q.	Flap surgery		Yes/No	
	r.	Implant placement		Yes/No	

s. Periapical surgeries Yes/No
t. Orthodontic treatment Yes/No
u. Endodontic treatment Yes/No

2. Which is the most commonly prescribed antibiotic by you?
   Duration of antibiotic course
3. Does your prescription vary when there is an evidence of anaerobic infection? Yes/No
   If yes, what would be your prescription?
   Duration of antibiotic course
4. How will you manage a case of a periapical/dentoalveolar abscess?
   a. Prescribe antibiotics and give an appointment later
   b. Establish drainage immediately and then prescribe antibiotics
   c. Establish drainage only; no antibiotic prescription

5. A patient presents with an orofacial infection and you have prescribed a course of antibiotics and given an appointment after few days. The patient returns back to you and there was no much improvement. What would you prefer to do in the following situation?
   a. Prescribe another course of antibiotics
   b. Send for antibiotic sensitivity testing and prescribe accordingly
   c. Refer the patient to another dentist for further management

6. Are you aware of the current guidelines for antibiotic prophylaxis and do you follow the same?
   Yes/No

7. Do you prescribe antibiotics for your patient in the postoperative period? Yes/No
   If yes, why do you prescribe

   Strict aseptic precautions in the peri-operatory period is enough to control postoperative infections in the surgical site without antibiotic prescription Yes/No

8. Do you feel antibiotic prescription is absolutely necessary to manage oral diseases Yes/No

9. Are you aware of the term "Antibiotic Resistance"? Yes/No

10. Injudicious prescription of antibiotics by dentists may be responsible for antibiotic resistance. Yes/No

11. Self medication with antibiotics by patients to treat dental problems may be responsible for antibiotic resistance. Yes/No

12. Do you enquire from your patient whether he/she has taken a course of antibiotics in the past one week before you prescribe it for him/her? Yes/No

13. Do you take measures to advice your patient to be compliant while taking antibiotics and inform the consequences of not being compliant to the same? Yes/No

14. Have you encountered any case of antibiotic resistance? Yes/No
    If so, how have you treated them? ……
    ……

15. What measures have you taken to combat antibiotic resistance?
    ……
    ……
    .....

RESULTS

TABLE 2: RESPONSES GIVEN BY THE SURVEY PARTCIPANTS

CONDITION	YES (%)	NO (%)
Tooth Sensitivity	11	89
Periodontal pockets	65.9	34.1
Halitosis	15.9	84.1
Tooth fracture	46.3	53.7
Dental caries	18.3	81.7
Dental caries with pulpitis	72	28
Dental caries with apical periodontitis	87.8	12.2
Periapical abscess	93.9	6.1
Dentoalveolar abscess	98.8	1.2
Orofacial infections with signs of systemic involvement	97.6	2.3

Asymptomatic impacted tooth	35.4	64. 6
Pericoronitis	75.6	24.4
Pericoronal abscess	92.7	7.3
Simple tooth extraction	72	28
Extraction by open method	90.2	9.8
Surgical removal of impacted tooth	96.3	3.7
Flap surgery	96.3	3.7
Implant placement	92.7	7.3
Periapical surgery	96.3	3.7
Orthodontic treatment	0	100
Endodontic treatment	84.1	15.9

TABLE NO: 3: COMPARISONS BETWEEN BDS AND MDS GRADUATES

Questions	**Response**	**BDS**		**MDS**		**p value**
		No.	**%**	**No.**	**%**	
Periodontal pockets	Yes	41	74.5	13	48.1	0.02
	No	14	25.5	14	51.9	
Tooth fracture	Yes	30	54.5	8	29.6	0.03
	No	25	45.5	19	70.4	
Dental caries with pulpitis	Yes	49	89.1	10	37.0	< 0.001
	No	6	10.9	17	63.0	
Dental caries with apical peiodontitis	Yes	53	96.4	19	70.4	< 0.001
	No	2	3.6	8	29.6	
Periapical abscess	Yes	54	98.2	23	85.2	0.02
	No	1	1.8	4	14.8	

IV. Discussion:

Data reported from various countries indicate differences in dentists' knowledge of clinical situations indicated for antibiotics. Other reasons for antibiotic over prescription is patient's expectation of an antibiotic prescription, convenience and demand necessitated by the social background of the patients, which are unscientific.[1] The present survey aimed to uncover antibiotic over prescription practices for common oral diseases in the dental practice.

In our survey, dentists were prescribing antibiotics for managing common oral diseases except for orthodontic treatment (Table 2). It was found that majority of BDS graduates relied on antibiotics to manage oral diseases than MDS graduates, which was statistically significant in few conditions (Table 2). This may probably be due to the inadequate understanding of the disease, less skill and competency in carrying out operative intervention measures.

Systemic antibiotics were prescribed for cases of tooth sensitivity, halitosis, simple tooth fracture, dental caries and its sequel like pulpitis, apical periodontitis, periapical abscess and dentoalveolar abscess in our survey results. These are not indicated for antibiotic therapy. This is an alarming finding among the dental practitioners about the misuse of antibiotics.

In our survey, antibiotics were prescribed for managing dental caries with pulpitis, which is in agreement with the findings of Dailey YM.[7] Pulpitis, apical periodontitis, sinus tract or localized swelling can usually be treated endodontically without the use of antibiotics. In our survey it was found majority of dental practitioners relied on antibiotics in addition to the endodontic treatment (Table 2). Few authors support prescription of antibiotics for routine endodontic treatment to prevent flare-ups.[8] On the contrary, others argue that certain immunological factors may be involved in a chronic, pre-existing lesion; flare-ups may be manifestations of multifactorial mechanisms, and antibiotics therefore may only be partially effective.[9] Mata et al suggests that many factors may be etiologically involved in the production of pain and swelling following endodontic therapy.[8] For instance, entrance of oxygen into the root canal during access may induce facultative aerobic bacteria to proliferate and produce inflammatory agents. Instrumentation and the air syringe can force bacteria into the canal and perhaps through the apical foramen. The use of local anesthetic or instrumentation might act as local irritants that cause an inflammatory response. Thus, there are many possible factors that might contribute to a flare-up. According to a systematic review, use of antibiotics to prevent flare-ups after endodontic treatment is not warranted.[10]Nevertheless, systemic antibiotics should be considered if there is a spreading infection that signals failure of local host responses in abating the advancing bacterial irritants, or if

the patients' medical history includes the condition or diseases known to reduce the host defense mechanism or expose the patient to high systemic risk.[11]

Periapical and dentoalveolar abscess should be drained through a pulpectomy or incision and drainage. Antibiotics were found to be prescribed for the management of periapical abscess even after establishing the drainage, which is uncalled for. Supporting evidence, indicate that antibiotics are of no additional benefit.[12]This amounts for overuse of antibiotics as per our survey results.

Clinical situations that require antibiotic therapy include infections accompanied by elevated body temperature and evidence of systemic spread like lymphadenopathy and trismus.[13] Facial cellulitis is a serious disease that should be treated by antibiotics promptly because of the possibility of infection spread via lymph and blood circulation, with development of septicemia.[1] Dentists in our survey prescribe antibiotics for orofacial infections with systemic signs of involvement, which is appropriate according to scientific literature.

Systemic antibiotics are increasingly used in the treatment of periodontal infections. Available evidence suggests, antibiotic prescribing should be exception rather than a rule and, in majority of cases, considered only after the conventional therapies have not been successful.[14, 15, 16, 17, 18] However, systemic antimicrobials should only be used in acute periodontal conditions where drainage or debridement is impossible, where there is local spread of the infection or where systemic upset has occurred.[19] There are also limited number of localized oral lesions that are indicated for antibiotic use which include periodontal abscess, acute necrotizing ulcerative gingivitis, and pericoronitis.[20]

The use of prophylactic antibiotics is a common practice, and has been widely accepted in the dental profession. The paradigm of this model of treatment is the prevention of bacterial endocarditis, indicated in risk patients in the context of any invasive procedure within the oral cavity – and following the guidelines of the American Heart Association (AHA).[21]However, there are doubts in relation to this practice. Firstly, transient bacteremia occurs not only after dental treatments such as extractions (35-80%) or periodontal surgery (30-88%). It also occurs in the context of tooth brushing (40%) or while chewing gum (20%), and is proportional to the trauma caused and to the number of germs colonizing the affected zone. [17]

Tooth brushing twice a day for one year produced a 154,000 times greater risk of exposure to bacteremia than a single tooth extraction. If other routine oral activities (such as chewing) are now applied to this model, then the number increases to 5.6 million times greater than that resulting from a single tooth extraction.[22] It has been estimated that 4% or less of all infective endocarditis cases are related to dental treatment induced bacteremia.[23, 24] Therefore, maintaining proper oral hygiene will prevent more bacterial endocarditis than antibiotic prophylaxis for dental treatment. However, adhering to the American Heart Association guidelines can be justified to prevent those trivial (4%) cases which may occur due to dental treatment. Majority of survey participants were aware of current guidelines for antibiotic prophylaxis, and expressed to be following the same.

Antibiotics were routinely administered has a prophylactic measure in our survey for third molar removal. There is no justification for routine antibiotic prophylaxis for third molar surgery.[25, 26, 27] Additionally, there is no scientific evidence for prophylactic antibiotic prescription for fit, non-medically compromised patients for dentoalveolar surgical procedures.[28] Contrary to the scientific evidence, dentists were seen prescribing antibiotics for routine dentoalveolar surgical procedures including simple extractions, which demands attention. Majority of the respondents felt adhering to the strict aseptic measures, in and around operative area during dental procedures is not enough to prevent infections; this might be the reason for majority of dental practitioners to prescribe antibiotics. However, medical letter on drugs and therapeutics recommends antibiotic prophylaxis for surgical procedures with a high infection rate and/or implantation of prosthetic devices. Applying this to the field of dentistry, antibiotic prophylaxis can be recommended only to the placement of dental implants. In our present survey, 92.7% dentists were found to be prescribing antibiotics for dental implant placement which is justifiable.

Penicillins in general, are the most commonly prescribed antibiotics by dentists. Similarly, majority of prescribed antibiotics in our survey was amoxicillin, followed by the ofloxacin and ornidazole, cephalexin, combination of amoxicillin and clavulinic acid. There is evidence that combination of amoxicillin and clavulinic acid besides being effective against oral microbes carries less risk for antibiotic resistance. Contrary to the scientific evidence, only 2.4% of our survey participants prescribed combination of amoxicillin and clavulinic acid, which needs attention.

The majority of orofacial infections resolve in 3 to 7 days.[29, 30, 31] In our survey, 38% dentists prescribe for 5 days. In recent years, more attention has been given to short courses.[32] Patients are reported to be benefitted after 2 or 3 days of antibiotic therapy.[32, 33, 34, 35] There are several advantages of short course therapy: increased convenience, improved compliance, and improved tolerability.[12, 36] Unfortunately, a false conception about the use of antibiotics is that antibiotics should be used for a certain number of days. Antibiotics should be used aggressively and for as short period as is compatible with patient remission of diseases.[37]The ideal antibiotic duration is the shortest time that will prevent both clinical and microbiological relapse. Most of the

dentists advise the patients to be compliant during the course of antibiotic therapy. This is an old admonition to regarding duration of antibiotic course. Such an approach is appropriate where rebound infections are common such as fungal, respiratory or urinary tract infections, which is unwarranted in dental diseases.[38]

Our survey findings suggest that antibiotics are prescribed indiscriminately, inappropriately and injudiciously to manage the oral diseases. Dental diseases are predominantly because of local factors; mere removal of the local causative factors reduces the need for prescribing antibiotics considerably. Despite the awareness on antibiotic resistance, dentists show lack of concern in curbing this grave public health problem. The need of the hour is to weigh the pros and cons of antibiotics before prescribing them to your patients. We recommend antibiotic prescription only when there is a real need. Antibiotics should be used only as adjuncts even when there is a real need; never the first line of treatment modality. Public needs to be educated at mass level against self-medication with antibiotics, which will help us in curbing antibiotic resistance to a greater extent.

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