

ORIGINAL ARTICLE

Antibiotic prescribing practices among Norwegian dentists

FAHRI DEMIRBAS, PER E. GJERMO & HANS R. PREUS

Department of Periodontology, IKO, Faculty of Dentistry, University of Oslo, Oslo, Norway

Abstract

Objective. There is little information on antibiotic prescribing habits among dentists in general. In 1992 we reported a study among Norwegian dentists, and the present investigation was undertaken to find out if the patterns of antibiotic prescription had changed since then. **Material and methods.** A total of 470 randomly selected dentists (10% of total) received a questionnaire and a letter describing the survey and 313 responded. **Results.** Results indicated that 35% did not issue any prescriptions in a typical week, while 3% issued ≥ 5 . Fifty percent reported that they might prescribe antibiotics when treating periodontal diseases, but only 3.4% reported the use of microbial diagnosis before selecting an antibiotic; 71% of the respondents reported use of antibiotics occasionally to prevent general complications of dental treatment; 80% prescribed antibiotics for prophylactic use if the patient revealed a history of endocarditis, while 5% reported never doing so. **Conclusion.** These findings are in concert with the results obtained 11 years ago, but indicating that dentists who had attended postgraduate courses on antibiotics prescribed such drugs more frequently. This was not statistically significant. However, it is of great concern that 5% never prescribed antibiotics when treating patients with a history of endocarditis, and that 20% did not know that amoxicillin was a penicillin. Such lack of knowledge may cause fatal results of therapy.

Key Words: *Antimicrobials, chemotherapy, dentistry, periodontal disease*

Since the general introduction of antibiotics in the treatment of infectious diseases after World War II, the various medical professions have experienced a rapid increase in the therapeutic use of such drugs. An unwanted side effect of this development has been that antibiotic-resistant bacteria have been introduced to man and his environment. Moreover, a selective pressure has been induced on the microbial populations of these ecosystems as a response to “non-degradable antibacterial compounds” in waste water and sewage from human and animal activity as well as from the use of antibiotics in bio-industry [1]. As the selective pressure increases and spreads within our environment, the probability for selecting resistant clones of pathogenic bacteria within the human ecosystem increases. Resistance to antibiotics limits the success of these agents in therapy and prevention of infectious diseases [2]. This urges the need for surveillance programs for antimicrobial resistance in human – as well as in veterinary medicine and food production, emphasizing the careful and prudent use of antibiotics currently marketed to ensure continuous clinical success [2–4].

Dentists have traditionally been exposed to patients showing a variety of infectious diseases. However, unlike the medical and veterinary professions, treatments of these infections (particularly caries and periodontal diseases) have traditionally been by taking a mechanical approach. Only occasionally has the experienced dentist used antibiotics to cure oral infections [5–7]. As the use of antimicrobial therapy against infections escalates, the need for educational programs becomes increasingly important among dentists, too. We believe that such educational programs must partly be built on the knowledge of current prescribing habits of the profession.

Previous studies among Norwegian dentists [6] have indicated a limited use of antibiotics when treating oral infections and that, generally, the correct drug for the different clinical indications has been prescribed. Based on the findings from this study [6], a postdoctoral educational program was designed and has been presented over the past 11 years to Norwegian dentists through the Norwegian Dental Association. The contents of the

Correspondence: Hans R. Preus, Department of Periodontology, Faculty of Dentistry, University of Oslo, P.O. Box 1109, Blindern, NO-0317 Oslo, Norway.
Tel: +47 2285 2163. Fax: +47 2285 2396. E-mail: hpreus@odont.uio.no

(Received 16 March 2006; accepted 1 June 2006)

ISSN 0001-6357 print/ISSN 1502-3850 online © 2006 Taylor & Francis
DOI: 10.1080/00016350600844394

course are mainly on periodontal issues, but general medical advice is also given, with an emphasis on special considerations when using antibiotics in dental medicine. Pharmacological and antimicrobial resistance issues are discussed extensively. The aim of the present study was to investigate the prescription pattern of Norwegian dentists in 2004 and to assess possible changes over the past decade.

Material and methods

A random sample of 10% of Norwegian dentists was selected from a commercial register of addresses ($n=470$). They were sent a letter describing the survey, definitions of what were considered to be antimicrobials, chemotherapeutics, and antibiotics, and requesting participation as well as granting anonymity. Enclosed with the letter was a questionnaire with mainly closed answers regarding demographics and individual antibiotic prescribing habits. One reminder was forwarded to participants who did not respond within a deadline. The response rate was 66.5%. The mean age of the respondents was 51 years, and the female proportion was 18%. In contrast, the average age of Norwegian dentists is 47 years, and females constitute more than 40% of the profession.

The questionnaires were read optically, and answers that were deemed incomplete by optical reading were read manually by the authors. Reasons for optical incompleteness were that some respondents did not mark their answers within the boxes provided; they marked several alternatives; they gave no answer or made written comments instead of marking the response boxes. Comments deemed understandable and in support of answers were included in the analyses, while uncertain comments or answers were disregarded. Differences in distribution were tested for significance by the chi-square test, and differences between means by ANOVA.

Results

Postgraduate course influence

More than 80% of the respondents had attended postgraduate courses on antibiotics during the previous 10 years. Participation in these courses did not significantly influence the weekly prescription frequency, although a trend towards prescribing more antibiotics and more diverse regimens was observed.

Frequency of antibiotic prescriptions

In a typical week, 49 (6%) respondents reported prescribing 1–2 prescriptions, whereas 2.9% reported prescribing antibiotics to their patients more than 5 times in the same typical period. The frequency of respondents who did not prescribe

antibiotics at all in a typical week was 34.8%. Neither the place of dental education, geographical area of workplace, nor age of the professional significantly influenced (chi-squared test) the weekly prescription frequency. However, there was a tendency towards more frequent prescriptions among younger members of the profession, and by dentists working in northern parts of Norway.

Pattern of antibiotics prescribed by dentists

Control of periodontal infections. Of the sample, 48% reported occasional use of antibiotics when treating periodontitis without the use of surgery. Forty-four percent reported using them when surgery was part of the treatment and an additional 4% reported routine use when treatment of the periodontal disease included surgery. More than half of the sample (56%) reported that, when applied, antibiotics were always given as an adjunct to mechanical therapy. Compared to periodontics, 82% of the dentists reported occasional use of antibiotics when performing endodontic therapy in general.

Antibiotics were prescribed by 38%, 34%, and 20% of the dentists when treating acute gingivitis, stomatitis, and herpes simplex infections, respectively, while 4%, 3%, and 1.5% reported that they prescribed antibiotics routinely in the above-mentioned cases.

Oral infections causing pain or general malaise. Sixty-five percent of the respondents reported that they occasionally prescribed antibiotics if the patient reported pain as the only symptom; 62% reported prescribing such drugs occasionally to patients suffering from abscesses *without* symptoms of general malaise; 6% reported routine prescription in such cases. Twenty-seven percent reported occasionally treating patients suffering from abscesses *with* the feeling of general malaise, but in such cases 72% prescribed antibiotics routinely.

Prophylactic use of antibiotics. This was reported by 71% of the sample as an occasional attempt to prevent general complications arising from dental treatment. Of these, 17% reported routine prescription of such regimens. In particular, 16% prescribed such drugs occasionally for prophylactic use if the patient revealed a history of endocarditis; 80% reported routine prescription, whereas 5% never prescribed antibiotics in this particular situation – a significant majority of these belonged to the group 55 years of age or older. Amoxicillin was the principal antibiotic prescribed by 56% of the respondents, whereas penicillin V was prescribed by 34%.

Type of antibiotics prescribed by disease category

Table I displays the prescription rate by disease category and type of antibiotic. Penicillin was the principal antibiotic prescribed, 62 (22%) dentists making this antibiotic their first choice in treating periodontal diseases without surgery, whereas 70 (25%) of them chose this antibiotic as an adjunct to periodontal surgery. Metronidazole was the first runner-up used by 53 (19%) general practitioners as an adjunct to regular scaling and root planning, whereas 28 (10%) of them prescribed this drug when performing periodontal surgery. Metronidazole was used twice as often as tetracycline. Ciprofloxacin was not used widely, with none of the respondents reporting use of this drug against periodontal infections. It was prescribed infrequently in other clinical situations, however.

Forty-five (20%) of the respondents opted for amoxicillin as their second choice antibiotic when the patient reported penicillin allergy, whereas 102 (46%) of the sample chose clindamycine in such cases.

Discussion

The results of this survey indicate that the amount of antibiotics prescribed by Norwegian dentists is still limited, as was observed in the study a decade ago. The response rate (66.5%) is relatively low. However, of more concern is that it may not be representative, because neither the gender distribution nor the average age of the respondents corresponds with the data on Norwegian dentists in general. The younger age groups and males were overrepresented among the respondents and it may be speculated that younger colleagues respond more favorably to some questions, i.e. prophylactic use in cases of endocarditis. Also, it cannot be disregarded that the relatively low response rate reflects general uncertainty regarding the use of antibiotics, or a lack of interest in the problem.

Only a few dentists prescribe antibiotics on a daily basis. There is also a low spectrum of the prescribed drugs – penicillins followed by metronidazole being the two most commonly prescribed antimicrobials for most oral infections. These findings are in concert with recent studies [8–10], where amoxicillin and metronidazole were the antibiotics most frequently used against different infectious conditions. There are also indications that antibiotics are by far the most prescribed drugs in general dental practices in the USA, but American dentists display more varied prescription habits, with tetracyclines being the most preferred drugs against periodontal diseases [7]. The average weekly drug prescription frequency for the American dentist 15 years ago was 2.9. Since this includes drugs other than antibiotics, e.g. pain relievers, tranquillizers, etc., it is reasonable to assume that the weekly prescription frequency of antibiotics approaches that of the Norwegian dentist. However, there is a great possibility that the prescription pattern for the American dentist has changed, leaving us without reasonable comparison possibilities in 2004.

There were only a few oral surgeons and periodontists in the present sample of dentists and, among them, only the oral surgeons applied a variety of different antibiotics. Compared to the survey 11 years ago, no significant difference was found between the prescription frequencies in dental practice [6]. However, there was a trend (not significant) for younger dentists, practising in northern parts of the country and those who had attended postgraduate courses on the topic, to prescribe more frequent and diverse antibiotics than reported a decade ago. A change in the pattern of drugs prescribed was observed as metronidazole was more frequently prescribed today than a decade ago, when tetracycline was the drug of choice [6]. This change in behavior may have been due to a more defined and pointed clinical and theoretical education program on antibiotics in periodontology at our faculties, and that this education emphasizes the correct and strict

Table I. Number of dentists prescribing antibiotics by clinical situations and type of antibiotic ($n = 283$)

Clinical situation	Metronidazole	Penicillin	Tetracycline	Ciprofloxacin	Combination	Amoxicillin	Other
Periodontal treatment without surgery	53	62	21		25	22	10
Periodontal treatment with surgery	28	70	23		25	18	8
Acute gingivitis	28	56	17		15	7	13
Pain, toothache	10	146	10		9	14	11
Stomatitis	9	42	10		9	3	43
Herpes simplex	2	9	4	1	4	2	45
Oral surgery	7	164	17		7	29	11
Oral medical treatment	5	63	8		9	14	24
Endodontics	32	178	18	2	32	34	9
Implantat therapy	4	32	3		5	11	5
Abscesses, unaffected general condition	15	160	11	1	11	14	7
Abscesses, affected general condition	27	221	20	2	31	31	10
In increased risk endocarditis	1	96	6	2	6	157	13
To prevent general medical complications	3	142	8		11	100	10

use of these drugs. In most situations, the majority of dentists used drugs and regimens "correctly" as described in generally accepted textbooks and as lectured in Norwegian dental schools. Penicillin was the most commonly prescribed drug in the treatment of periodontitis in this survey, although there are general recommendations in all current textbooks to use metronidazole, combination therapies, or tetracycline. This emphasizes the continuing strong position of phenoxymethylpenicillin in Norwegian dental infection medicine over the past decade, but it is not readily understood since penicillins are not predictive when used against periodontal diseases due to the composition of and resistance to antibiotics in subgingival biofilms [11,12].

Very few dentists (3.4%) applied microbiological diagnoses in their rationale for deciding on which antibiotics to use in the treatment of different periodontal diseases. There are currently two laboratories offering microbiological diagnostic services to Norwegian dentists. Eleven years ago only 1.3% of dentists used this service. According to these laboratories, approximately 500 dentists throughout the country use their services to varying degrees. This amounts to 12.5% of all dentists, so our questionnaire may not have been appropriately formulated to pick up on this issue. There is no doubt that if one chooses to apply antibiotics against periodontal disease, it is appropriate to apply a bacterial diagnosis first. Specific periodontal infection may be due to superinfections with yeasts, intestinal bacteria, or other microorganisms not so commonly found in the oral cavity [13]. Moreover, periodontal disease may be due to specific infection with bacteria with varying resistance to various antibiotics. A strict prerequisite is that an antibiotic with a narrow antimicrobial spectrum should be used in such cases. Metronidazole is the most narrow-spectrumed antibiotic only covering most of the anaerobic bacterial flora. A subgingival biofilm may have representatives from anaerobic, facultative anaerobic, and aerobic microorganisms, which may or may not have natural or induced resistance to certain antibiotics. Thus, microbiological diagnosis may be valuable in the design of the therapy needed in such cases. Finally, the treatment of chronic periodontal disease does not need to be rushed to be effective. In most cases there is good time to gather information on microbiological parameters before selecting treatment strategy [14].

Five percent of the dentists would not have prescribed prophylactic antibiotics when treating patients who had a defined history of bacterial endocarditis. The question did not pertain to a *potential* risk of endocarditis, but to whether the dentist would use antibiotic prophylaxis in patients who directly reported having suffered bacterial endocarditis. Eleven years ago, 32% of the general dentists did not prescribe prophylactic antibiotics in

such obvious cases, and in that respect the reduction from 32% to 5% is relieving. Still, 5% is too high and calls for a serious evaluation of our information routines. Moreover, phenoxymethylpenicillin is still the preferred antibiotic in such situations according to our study, even though it is made abundantly clear by the universities, as well as in every continuous educational course, that amoxicillin should be used [15,16].

Our study from 1992 raised the same worries, whereas the present study clearly shows a significant improvement in knowledge and clinical awareness about these specific problems. However, it is a matter of serious concern that 20% of our dentists gave answers indicating that they did not know that amoxicillin was a type of penicillin and could not be used in cases of penicillin allergy. One would expect that this shortcoming in knowledge would generate reports on allergy and anaphylaxis, so when this is not happening it is probably because penicillin allergy is rarer than allergic reactions, and suspicions of allergy may be misdiagnosis of the adverse effect "penicillin rash". However, this lack of knowledge is a serious finding, and since it is difficult in general practice to distinguish between allergy and side effects of this kind, this should make the dentist treat such reports from the patient as an allergy and act as if it was.

Conclusions

- 1) It is worrying that the continuous education course, designed specifically on the basis of the results of the survey 11 years ago, seems to have had little or no effect, because 80% of the present population report having attended the described or other relevant courses.
- 2) It is worrying that phenoxymethylpenicillin is still the antibiotic of choice when treating periodontal disease.
- 3) It is worrying that most dentists do not perform a proper microbial diagnosis before selecting an antibiotic as adjunct periodontal therapy.
- 4) It is a matter of serious concern that 5% of dentists still do not apply antibiotic prophylaxis when the patients specifically report a history of bacterial endocarditis.
- 5) It is a matter of serious concern that 20% would use amoxicillin as a replacement for phenoxymethylpenicillin in cases of penicillin allergy.

Acknowledgments

We thank Henriette Magnussen for help in preparing the manuscript. This study was conducted as part of the specialist education curriculum by the main author, and was not sponsored by other than the Dental Faculty of the University of Oslo, Norway.

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