

# A study of prophylactic antibiotic prescribing in National Health Service general dental practice in England

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**Objective** To study the use of prophylactic antibiotics by general dental practitioners.

**Design** A postal questionnaire of National Health Service (NHS) general dental practitioners in ten English Health Authorities.

**Subjects** General dental practitioners (GDPs) (1544) contracted to provide NHS treatment in the Health Authorities of Liverpool, Wirral, Oxfordshire, Buckinghamshire, Nottingham, North Nottinghamshire, Sheffield, Newcastle, Northumberland and North Tyneside.

**Main outcome measures** The questionnaires were analysed and the responses to each question expressed as absolute frequencies.

**Results** Responses to the questionnaires were received from 929 (60.1%) practitioners. Over 40% of general dental practitioners would prescribe prophylactic antibiotics for patients with no relevant medical history for minor oral surgery to prevent postoperative infection. Amoxicillin was the predominant choice of antibiotic in this situation. Between 15–67% of GDPs failed to prescribe prophylactic antibiotics for at risk medically compromised patients. GDPs also prescribed for patients with a medical history not known to be at risk from dental procedures. Over 50% of GDPs however, would seek specialist advice about prophylaxis if they were unsure of the indications and over 90% of GDPs indicated they would use the current recommended regime for antibiotic prophylaxis for patients at risk of infective endocarditis.

**Conclusions** The evidence from this study suggests that a significant number of the practitioners surveyed prescribe prophylactic antibiotics inappropriately, both for surgical procedures and for patients at risk from endocarditis. There is also evidence that practitioners prescribe antibiotic prophylaxis for clinical procedures and medical conditions for which there is little evidence. The results suggest that there is a need for the development of guidelines for practitioners on the appropriate prophylactic use of antibiotics.

Approximately one third of all antibiotics used in medicine are prescribed for prophylactic purposes.<sup>1</sup> In dentistry prophylactic antibiotics are prescribed to either prevent serious life threatening complications (e.g. infective endocarditis), or to prevent infection following surgical treatment. Antibiotic prophylaxis in non-medically compromised patients remains a contentious area

of clinical practice<sup>2</sup> but is an important area medico-legally for medically compromised patients.<sup>3</sup> The benefits of antibiotic prophylaxis need to be balanced against the risks of allergic reactions, toxicity, side effects and the increasing problem of antimicrobial resistance.<sup>4–5</sup>

Previous studies in general dental practice have centred on how practitioners prescribe prophylactically to prevent endocarditis.<sup>6–7</sup> There is however some evidence that prophylactic antibiotics are being prescribed in dentistry when there is little evidence that they would have any beneficial effect.<sup>8</sup> The purpose of this study was to investigate when and for which clinical procedures prophylactic antibiotics were being prescribed by National Health Service GDPs in England.

## Method

### Questionnaire

A questionnaire was devised to investigate when GDPs would prescribe prophylactic antibiotics and the regime used. The questions used were first evaluated in a pilot study and after modification, the questionnaire was sent to a sample of GDPs in England.

The first part of the questionnaire sought to determine for which specific dental procedures practitioners would prescribe antibiotics for patients who were not medically compromised. The specific dental procedures were surgical extractions, apicectomy and before or after root canal therapy. The practitioners who prescribed for any of the procedures listed were asked to state their preferred choice of antibiotic.

The next part of the questionnaire asked which specific antibiotic and regime practitioners would use for medically compromised patients requiring prophylaxis, who were not allergic to penicillin. A further question asked what antibiotic regime would be used for medically compromised patients, allergic to penicillin, requiring prophylaxis.

The final part of the questionnaire sought information on the medical conditions and dental procedures for which practitioners might prescribe prophylactic antibiotics. The dental procedures were scaling and polishing, class II and V subgingival restorations, root canal therapy, extractions and impressions. The medical conditions are listed in Table II and included patients with cardiac and immunological problems, renal pathology and transplantation, prosthetic joints and radiotherapy treated head and neck cancer together with diabetes, Hodgkin's disease and AIDS. GDPs were also asked whether they would seek specialist advice on the need to provide prophylactic antibiotics before treatment for each of the medical conditions.

### Sample and data handling

Ten health authorities were chosen for sampling and these were Liverpool, Wirral, Oxfordshire, Buckinghamshire, North Tyneside, Northumberland, Newcastle, Nottingham, North Nottinghamshire and Sheffield. All GDPs contracted to provide NHS General Dental Services (GDS) were included apart from specialist

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**Table 1 Clinical procedures for which GDPs (n=891) prescribe antibiotics and the antibiotics used for patients with no relevant medical history and no allergy to penicillin**

Procedure	% of GDPs	Antibiotic choice
Apicectomy	43.5	Amoxicillin 28.5% Penicillin 9% Metronidazole 6%
Surgical extractions	38.9	Amoxicillin 26.5% Penicillin 7.5% Metronidazole 4.9%
Before root canal treatment	5.4	Amoxicillin 3.6% Penicillin 1.1% Metronidazole 0.9%
After root canal treatment	2.8	Amoxicillin 1.7% Penicillin 0.6% Metronidazole 0.8%

NB Some practitioners indicated more than one antibiotic

orthodontic practitioners. The questionnaire was distributed so that no respondent could be identified. The responses were entered into a Statistical Package for Social Science (SPSS) database<sup>9</sup> and the overall response rate and percentage responses for each question were calculated.

**Results**

A total of 929 replies were received giving a response rate of 60.1%. Some of the responses were returned incomplete (38) and were not used so 891 were analysed.

**Prophylactic antibiotics for specific dental procedures for non-medically compromised patients**

Table I shows the antibiotics used for specific clinical procedures in

non-medically compromised patients who were not allergic to penicillin. Practitioners prescribed antibiotics for surgical extractions (38.9%) and apicectomies (43.5%) with amoxicillin, penicillin and metronidazole being the antimicrobials most frequently prescribed. Some practitioners indicated more than one choice of antibiotic.

**Prophylactic regimes for medically compromised patients**

Table II shows the medical conditions and procedures for which GDPs might consider prescribing prophylactic antibiotics. Only a minority of dental practitioners considered that a history of diabetes, haemodialysis, Hodgkin's disease and AIDS, immunosuppressive therapy, autoimmune disorders and renal transplant were an indication for prophylactic antibiotics. With the exception of diabetes the majority of respondents felt they would seek specialist advice for the other conditions. The response to cardiac conditions, apart from patients with aortic stenosis and ventricular septal defects, was that the majority of practitioners would give antibiotics for extractions, restorations involving the gingival margin, scaling and polishing but not impressions. Coronary heart disease and bypasses, pacemakers and physiological murmurs were not generally seen as an indication for prophylactic antibiotic cover. Approximately 25% felt that a history of prosthetic joints was an indication for prophylactic cover, with approximately 40% of GDPs providing cover for patients with a history of rheumatic fever with no valvular dysfunction when carrying out scaling and polishing and extractions. Only 21.8% felt there was a need to provide antibiotic prophylaxis for extractions on patients who had undergone radiotherapy to the head and neck.

**Table 2 Medical conditions and procedures for which GDPs provide antibiotic prophylaxis (n=891)**

Medical History	% of dentists providing prophylaxis for procedures listed						
	Scaling & polishing	Fillings-Class II subgingival	Fillings-Class V subgingival	Root canal therapy	Extractions	Impressions	Seek specialist advice
Diabetes mellitus	1.1	0.7	0.7	3.6	15.8	0.1	3.5
Haemodialysis patients	5.1	3.4	3.2	5.0	8.4	0.2	48.9
Hodgkins disease	2.5	1.1	1.1	1.9	4.4	0.2	43.8
Aids	6.7	4.2	4.1	5.9	11.3	0.5	58.0
Patients on immunosuppressives	10.7	6.7	6.6	10.0	19.9	0.8	56.0
Patients with autoimmune disease	3.6	1.9	2.0	3.3	6.8	0.3	47.6
Renal transplant patients	13.5	8.6	8.0	10.6	17.4	1.0	51.2
Radiotherapy to head and neck	6.0	3.6	3.5	6.2	21.8	0.8	42.3
Patients with prosthetic joints	21.8	13.8	13.5	17.2	25.2	0.8	16.0
History of infective endocarditis	86.2	64.4	63.7	71.8	88.3	7.6	17.0
Cardiac valve prosthesis	84.4	60.2	59.8	67.9	87.0	5.7	11.0
Rheumatic heart disease	89.4	63.1	63.5	72.1	92.0	5.5	7.8
Aortic stenosis	33.9	23.5	23.0	25.6	33.9	1.9	29.5
Ventricular septal defect	55.1	38.0	38.0	43.0	56.0	3.2	29.0
Coronary by-pass surgery	12.8	9.2	9.0	10.5	14.4	1.1	17.0
Rheumatic fever- no valvular dysfunction	38.8	24.0	24.3	30.1	40.2	2.4	22.5
Coronary heart disease	2.7	1.7	1.8	2.3	3.5	0.2	9.5
Pacemakers	6.8	5.1	5.3	5.9	7.9	1.0	10.1
Physiological/innocent murmurs	8.3	4.9	5.0	6.2	9.6	0.6	23.4

**Table 3 GDPs' choice of antibiotic regime for medically compromised patients not allergic to penicillin (n=891)**

Antibiotic regime	% of dentists
Amoxicillin 3g 1 hour preop	90.6
Clindamycin 600mg 1 hour preop	14.9
Amoxicillin 3g 1 hour preop +500mg 6 hours later	9.2
Erythromycin stearate 1g 1 hour preop + 500mg 6 hours later	3.1
Metronidazole 200mg 3x daily for 3 days	2.8
Penicillin V 2g 1 hour preop + 1g 6 hours later	0.6
Tetracycline 1g preop +500mg 6 hours later	0.1

NB Some dentists use more than one regime for prophylaxis

**Table 4 Antibiotic prophylactic regime used by GDPs (n=891) for medically compromised patients allergic to penicillin**

Antibiotic	Dose	% of GDPs
Clindamycin	600mg 1 hour preop	77.1%
Erythromycin stearate	1g 1 hour preop +500mg 6 hours later	18.6%
Metronidazole	200mg 3 times daily for three days	3.3%
Tetracycline	1g 1 hour preop 500mg 6 hours later	2.2%

NB Some GDPs indicated more than one regime.

### Antibiotics for medically compromised patients

The prophylactic antibiotics used by GDPs for medically compromised patients not allergic to penicillin are shown in Table III. A single 3g dose of amoxicillin was the choice of prophylactic antibiotic cover provided by 90.6% of the respondent GDPs; a two dose regime of amoxicillin was used by 9.2% of respondents. Other regimes included clindamycin (14.9%), metronidazole (2.8%), penicillin (0.6%) and tetracycline (0.1%). Some GDPs indicated more than one regime. The antibiotics used for patients allergic to penicillin, shown in Table IV, were mainly clindamycin (77.1%), erythromycin stearate (18.6%) with a small percentage prescribing metronidazole or tetracycline.

### Discussion

This study investigated the use of prophylactic antibiotics by general dental practitioners. It was the second part of a questionnaire which also investigated the therapeutic use of antibiotics. The details of the rationale, choice and analysis of the sample have been discussed previously.<sup>10</sup> Responses to the questionnaire were received from 929 GDPs, which is 5.9% of those dentists practising within the NHS General Dental Services in England. This is the largest study reported concerning the prophylactic antibiotic prescribing practices of GDPs in the UK.

A large proportion of the respondents to the questionnaire prescribed prophylactic antibiotics for apicectomies (43%) and surgical extractions (39%). This is a high proportion considering that the rate of post-operative infection from both procedures is low and there is some evidence that antibiotics have little or no effect.<sup>11-12</sup> Antibiotics should never be used as a substitute for good surgical and aseptic operating techniques.<sup>2</sup> Amoxicillin was the most prescribed antimicrobial for these procedures. This is a logical choice as it attains high serum concentrations and is effective against facultative and some anaerobic flora that may cause post-operative infection.<sup>13-14</sup> Penicillin was the next most popular prophylactic antibiotic but resistance by both the oral facultative and anaerobic bacteria lessens its usefulness. The choice of prophylactic metronidazole is also appropriate as anaerobes are usually involved in post-operative infection.<sup>16</sup>

Encouragingly, only a small proportion (<6%) of the respondent practitioners used antibiotics before or after root canal therapy. The use of antimicrobials before or after root canal therapy is controversial so the indiscriminate use of antibiotics during root canal therapy should be discouraged.<sup>17-18</sup> The use of antimicrobials during root canal therapy has been shown to prevent flare-ups during multi-visit treatments and to reduce postoperative pain and swelling when root filling asymptomatic teeth with pulpal necrosis and with associated periapical lesions.<sup>19-20</sup> There is, however, little indication for this if good technique is employed in canal preparation and obturation.<sup>18</sup>

Knowledge of the interaction of restorative treatment with patients who had a history of AIDS, Hodgkin's and autoimmune disease, diabetes or haemodialysis was good, with the majority of practitioners not prescribing any prophylactic antibiotics. However, between 4% and 19.9% would prescribe prophylactic antibiotics for extractions with these medical conditions. The value of prophylactic antibiotics in all of these conditions for prevention of post-operative complications is questionable or unproven, with the Working Party of the British Society for Antimicrobial Chemotherapy (BSAC) stating that there is no need for antibiotic prophylaxis for dental treatment.<sup>21</sup> In contrast, radiotherapy to the head and neck is known to affect the blood supply and prophylactic antibiotics are essential for extractions to prevent post-operative infection:<sup>22</sup> only 21.8% of respondents in this study indicated they would prescribe them.

The use of antibiotics for patients with prosthetic joints has been reviewed by a number of workers and it is generally agreed that they

are not indicated.<sup>23,24,25</sup> In this study a quarter of respondents (25.2%) would prescribe prophylactic antibiotics for patients with prosthetic joints for extractions and between 13.5–21.8% would use them for restorative procedures and scaling and polishing. The prophylactic use of antibiotics for this group of patients undergoing dental treatment has been investigated following concerns that there is a transient bacteraemia produced which could localise on prostheses leading to infection. The bacteria associated with late infections of joint replacements are mainly staphylococci and beta haemolytic streptococci which do not form part of the normal oral flora and are rarely isolated from dentally related bacteraemias.<sup>23,24</sup> There is little justification for prophylaxis for these patients. The BSAC Working Party does not support the routine use of prophylaxis for dental procedures carried out on patients with prosthetic joints.<sup>25</sup> The relatively high number of GDPs who would prescribe in this study may reflect ignorance of recommendations or advice from overprotective orthopaedic surgeons.

A high proportion of the GDPs followed current guidelines on antibiotic prophylaxis for patients with cardiac problems that could predispose to infective endocarditis, except in the case of aortic stenosis and ventricular septal defects.<sup>26</sup>

The use of prophylactic antibiotics for restorative procedures is contentious and must be based on the likelihood of inducing a bacteraemia. The consensus of opinion is that the placement of restorations subgingivally does not require prophylaxis.<sup>27</sup> Within this study there was however, a large number that associated any involvement of the gingival margin during dental procedures with a significant risk of bacteraemia and would therefore prescribe prophylactic antibiotics. In addition, a high proportion of practitioners associated any history of rheumatic fever, even those with no valvular pathology, with a risk of infective endocarditis and would prescribe prophylactic antibiotics. In contrast, the majority of practitioners in this survey understood that pacemakers, coronary heart disease and innocent murmurs did not need prophylactic antibiotics.<sup>22,28</sup>

In this study, the choice of prophylactic antibiotic regime, by most GDPs (99%), for medically compromised patients not allergic to penicillin fell within the BSAC recommended guidelines.<sup>21</sup> A small number of practitioners used regimes known to be ineffective against some oral bacteria. For patients who were allergic to penicillin, clindamycin or erythromycin was the most used prophylactic antibiotic, which follows recommended guidelines.<sup>21</sup>

### Conclusions

There was evidence from this study that general dental practitioners are overusing prophylactic antibiotics particularly for surgical procedures. GDPs err on the side of caution with regard to medically compromised patients, prescribing when there is no indication, and yet failing to prescribe when there is an overwhelming need to do so.

Although a thorough medical history and dialogue with the patient's medical practitioner and specialist is imperative, there remains a need for clear evidence based guidelines for practitioners on the prophylactic prescribing of antibiotics in order to reduce inappropriate prescribing.

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- 1 Neu H C. Prophylaxis — has it at last come of age? *J Antimicrob Chemother* 1979; 5: 331-3.
- 2 Longman L P, Martin M V. The use of antibiotics in the prevention of post-operative infection: a re-appraisal. *Br Dent J* 1991; 170: 257-62.
- 3 Martin M V, Butterworth M L, Longman L P. Infective endocarditis and the dental practitioner: a review of 53 cases involving litigation. *Br Dent J* 1997; 182: 465-8.

- 4 Monitoring and Management of Bacterial Resistance to Antimicrobial Agents: a World Health Organisation Symposium. *Clin Infect Dis* 1997; 24 (suppl 1): S1-176.
- 5 Standing Committee of Science and Technology. *Resistance to antibiotics and other antimicrobial agents*. London: The Stationary Office: House of Lords, 1998.
- 6 Holbrook W P, Willey R F, Shaw T R. Prophylaxis of infective endocarditis. *Br Dent J* 1983; 154: 36-9.
- 7 Holbrook W P, Higgins B, Shaw T R. Recent changes in antibiotic prophylactic measures taken by dentists against infective endocarditis. *J Antimicrob Chemother* 1987; 20: 439-46.
- 8 Palmer N O A, Ireland R S, Palmer S E. Antibiotic prescribing patterns of a group of general dental practitioners: results of a pilot study. *Primary Dental Care* 1998; 5: 137-141.
- 9 SPSS for Windows Base Version [program]. 9.0.0 version. Chigaco IL 60611: SPSS Inc, 1998.
- 10 Palmer N O A, Pealing R, Ireland R S, Martin M V. A Study of therapeutic antibiotic prescribing in National Health Service general dental practice in England. *Br Dent J* 2000; 188: 554-558.
- 11 Longman L P, Martin M V. A Practical Guide to Antibiotic prophylaxis in Restorative Dentistry. *Dental Update* 1999; 26: 7-14.
- 12 Rud J. Removal of impacted lower third molars with acute pericoronitis and necrotising gingivitis. *Br J Oral Surg* 1970; 7: 153-60.
- 13 Gill Y, Scully C. Orofacial odontogenic infections: review of microbiology and current treatment. *Oral Surg Oral Med Oral Pathol* 1990; 70: 155-8.
- 14 Von Konow L, Nord C E, Nordenram A. Anaerobic bacteria in dentoalveolar infections. *Int J Oral Surg* 1981; 10: 313-22.
- 15 Woods R. Twenty years of antibiotic sensitivity testing of dental infections. Part 1. Antibiotic sensitivities, 1980 to 1986. *Aust Dent J* 1988; 33: 420-3.
- 16 Rood J P, Murgatroyd J. Metronidazole in the prevention of 'dry socket'. *Br J Oral Surg* 1979; 17: 62-70.
- 17 Abbott P V, Hume W R, Pearman J W. Antibiotics and endodontics. *Aust Dent J* 1990; 35: 50-60.
- 18 Whitten B H, Gardiner D L, Jeansonne B G, Lemon R R. Current trends in endodontic treatment: report of a national survey. *J Am Dent Assoc* 1996; 127: 1333-41.
- 19 Abbott A A, Koren L Z, Morse D R, Sinai I H, Doo R S, Furst M L. A prospective randomized trial on efficacy of antibiotic prophylaxis in asymptomatic teeth with pulpal necrosis and associated periapical pathosis. *Oral Surg Oral Med Oral Pathol* 1988; 66: 722-33.
- 20 Morse D R, Furst M L, Belott R M, Lefkowitz R D, Spritzer I B, Sideman B H. Infectious flare-ups and serious sequelae following endodontic treatment: a prospective randomized trial on efficacy of antibiotic prophylaxis in cases of asymptomatic pulpal-periapical lesions. *Oral Surg Oral Med Oral Pathol* 1987; 61: 96-109.
- 21 *Dental Practitioners Formulary 1998-2000, British National Formulary No36*. The Royal Pharmaceutical Society of Great Britain and the British Medical Association. London, 1998.
- 22 Pallasch T J, Slots J. Antibiotic prophylaxis for medical-risk patients. *J Periodontol* 1991; 62: 227-31.
- 23 Little J W. Patients with prosthetic joints: are they at risk when receiving invasive dental procedures? *Spec Care Dentist* 1997; 17: 153-60.
- 24 Field E A, Martin M V. Antibiotic prophylaxis for patients with prosthetic joints undergoing dental treatment. *Br Dent J* 1991; 171: 352-3.
- 25 Working Party of the British Society for Antimicrobial Chemotherapy. Case against antibiotic prophylaxis for dental treatment of patients with joint prostheses. *Lancet* 1992; 1: 301.
- 26 Working Party of the British Society for Antimicrobial Chemotherapy. Antibiotic prophylaxis of infective endocarditis. *Lancet* 1990; 1: 88-89.
- 27 Dajani A S, Taubert K A, Wilson W, Bolger A F, Bayer A, Ferrieri P, et al. Prevention of bacterial endocarditis. Recommendations by the American Heart Association. *Journal Am Med Assoc* 1997; 277: 1794-801.
- 28 Lockhart P B, Schmidtke M A. Antibiotic considerations in medically compromised patients. *Dent Clin North Am* 1994; 38: 381-402.