

The Path of Least Resistance in Oral Surgery

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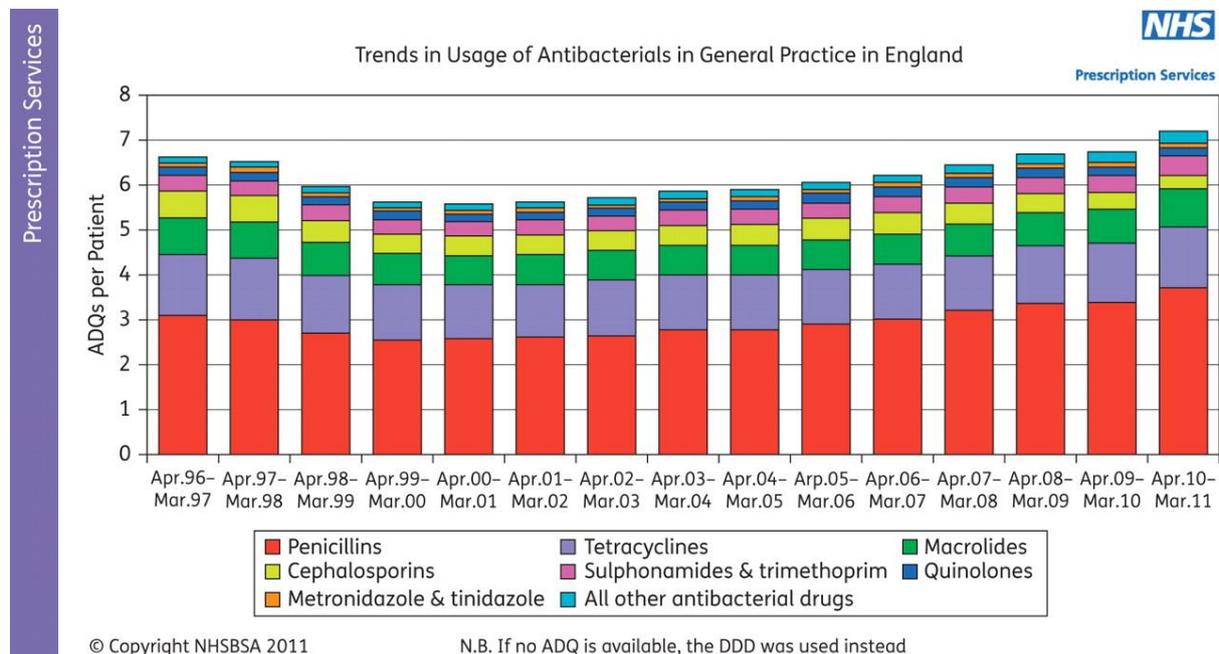
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Introduction

The World Health Organization has identified Antibiotic Resistance as a major threat to public health worldwide.¹ There are an estimated 25,000 deaths in Europe annually due to antibiotic resistance.² Antimicrobial resistance is caused by over-use of antibiotics and inappropriate prescribing habits.

The dental profession are globally responsible for between 7-11% of all antibiotic prescriptions.³ Indiscriminate prescribing practices amongst dentists particularly in the field of oral surgery needs to be targeted. Inappropriate prescribing of antimicrobials leads to selection and dominance of resistant micro-organisms. The exchange of genetic material can also increase resistance resulting in resistant genes spreading between populations of bacteria.⁴ As a consequence antibiotics are becoming less effective and contribute to infections which are increasingly difficult to treat. The number of infections emerging due to multi-drug resistant organisms is rising sharply and the timeline for the development of new antibiotics is limited. In addition there is tremendous expense involved in developing new drug therapies to treat such patients.

The dental profession must demonstrate leadership by helping to reduce the impact of antibiotic resistance in the future.



(Diane Ashiru-Oredope et al. J. Antimicrob. Chemother. 2012;67:i51-i63)

Antibiotic Stewardship

Antimicrobial stewardship is an organizational approach to promoting and monitoring conservative use of antimicrobials to maintain their ongoing effectiveness.⁵

The objective of Antimicrobial stewardship is to improve antibiotic prescribing patterns. Antibiotic resistance poses a detrimental threat to the elderly, children and patients with weakened immune systems. However an increase in infections that are more difficult to treat not only affects vulnerable patients but also the wider community. Bacterial resistance can complicate the treatment of even mild infections.

Educating the dental profession and the public in the judicious use of antibiotics as part of an antimicrobial stewardship programme is imperative in safeguarding this vital medicine. Unfortunately, patients have come to expect antibiotics for 'toothache', which is an inflammatory condition and is best managed with local measures in combination with analgesics. Good communication and reassurance by the dental profession must enforce 'antibiotic stewardship'. However an unscheduled emergency often presents a profoundly difficult situation for the dentist. As a profession we're increasingly vulnerable to regulatory criticism if we cannot justify our care to our patients in circumstances of acute pain.

Doron and Davidson stressed three important aims with antimicrobial stewardship:⁶

- Optimize treatment for patients
- Prevent inappropriate prescribing
- Reduce development of resistance in the individual patient and therefore the wider community

The dental profession must show leadership in slowing the development of antimicrobial resistance by demonstrating more judicious prescribing in both private and hospital settings.

The Human Microbiome

The human microbiome consists of the microbes, along with their genes and genomes, that live in and on the human body. These resident microbes are important to our health as they play a significant role in maintaining our immune systems, contributing to digestion and acting as a first line of defense against pathogens. Researchers now believe that many diseases may be the result of disturbed microbiomes. The current understanding indicates that the human body is made up of 10 times more microbial cells than human cells. It is thought that there may be millions more microbial genes than human genes in this human and microbiome system and it is in the ways in which these microbial genes interact with the human host that describe their ultimate role in health.⁷

At the same time as we are beginning to appreciate the microbiome, scientists are growing concerned about things that we are doing that may disturb this delicate system. Antibiotic resistance develops when bacteria are exposed to sublethal doses of an antibiotic that instead of killing them allow them to develop genetic resistance against the antibiotic.

Antibiotics can also kill beneficial bacteria in our microbiomes. There is thought to be a relationship between the theorized disturbance in the human microbiome through antibiotic use and the unexpected rise in autoimmune diseases and allergies, particularly in Western countries. Autoimmunity is the failure of our own immune system to distinguish 'self' from 'nonself'. This failure can lead to an immune response being mounted against our own cells and tissues. Examples of autoimmune diseases include rheumatoid arthritis, lupus, diabetes and celiac disease. Current thinking is that antibiotics cause the loss of normal microbiome constituents removing the necessary triggers for normal immune system development. As a result, an underdeveloped immune system might possibly encourage autoimmune diseases to develop.⁸

Clostridium Difficile

Clostridium difficile are bacteria that naturally inhabit the gut. C. difficile generally does not cause problems in healthy people. However antibiotic overuse in dentistry can upset the harmony of bacteria in the gut. C. difficile infection occurs when these bacteria multiply and produce toxins resulting in symptoms such as diarrhoea and fever.

There were 1,696 new cases of C. difficile infection documented in Ireland throughout 2010. The majority of these patients completely recovered however on rare occasions this infection can prove fatal.⁹

Indications for prescribing antibiotics¹⁰

- An adjunct to managing acute/chronic infections
- Management of active infective disease
- Delay in treatment due to uncooperative behavior requiring referral to specialist services. This may happen for instance if a dentist is unable to establish drainage and the patient requires sedation/GA.¹¹

However in the field of oral surgery clinical situations that require antibiotic therapy are limited. Indications include oral infection accompanied by elevated body temperature and signs or symptoms of systemic spread such as lymphadenopathy and trismus. Facial cellulitis with or without dysphagia also requires immediate antibiotic treatment to prevent the spread of infection through lymph and blood circulation which could culminate in septicemia.¹² Most dental infections can be successfully resolved by removal of the source. However there is still a worrying tendency among dentists to favour an antibiotic prescription over immediate dental treatment.¹³

Where management of dento-alveolar infections in children and immunocompromised patients are concerned early treatment is imperative. Local infections can spread very quickly culminating in life-threatening consequences such as Ludwig's Angina.¹⁴

Short courses of antibiotic therapy help to reduce the risk of antibiotic resistance.¹⁵ Antibiotics used for short courses should have rapid onset of action, not promote resistant mutants, demonstrate bactericidal activity, easily penetrate into tissues and not be affected by adverse infection conditions.¹⁶

Acute Dento-Alveolar infections

- Antibiotics are only indicated as an adjunct to local treatment where the patients temperature is increased and there is evidence of systemic spread and local lymph gland involvement.¹⁷
- If the infection has resolved three days post-drainage or removal of the cause and the temperature has returned to normal then antimicrobials can be stopped.¹⁸

Chronic Dento-Alveolar Infections¹⁰

These usually present as a well localized abscess sometimes with a sinus but rarely require antibiotics unless:

- Grossly spreading or acute flare-up of infection
- Increased temperature or malaise (FGDP)

Pericoronitis

Antimicrobials should not be required unless:¹⁹

- Elevated temperature
- Severe localized infection, spreading infection or persistent swelling despite treatment
- Trismus

Metronidazole is the first choice of antibiotic.

Prophylactic Antibiotic Use in Third Molar Surgery

Interestingly it was proven that 12 people would need to receive antibiotic prophylaxis to prevent one infection.²⁰ Antibiotics are frequently prescribed in a prophylactic way in cases where surgery is complex and in patients suffering with systemic conditions causing immunodeficiency such as HIV, diabetes and cancer.²¹ It is likely that antibiotics

are more advantageous in immunocompromised patients as infections in this group are more frequent and difficult to resolve.

However there is no evidence that antibiotics prevent fever, swelling or problems with restricted mouth opening in patients who have had their wisdom teeth extracted. Therefore the administration of antibiotics in healthy people to eliminate the risk of infections may cause more harm than benefit to both the individual patient and the wider population.

Using antibiotics was found to lead to at least one adverse effect for every 21 people treated. Although the adverse effects reported were mild and transient.²²

It appears that medically compromised patients benefit the most from antibiotic therapy. However there seems to be very little clinical gain from prescribing post-operative antibiotics alone for oral surgical procedures.

There is no evidence to advise the prophylactic use of antibiotics after surgical extraction of impacted teeth/roots to reduce infection postoperatively. Evidence exists that there is no decrease in post-operative infection, pain, swelling or wound healing post-operatively.²³

Dry Socket

Dry socket is a post-extraction complication which follows the break-down of the blood clot and occurs as a result of bacterial invasion. Its incidence is in the region of 4%.²⁴

Studies have proven that approximately 38 healthy people would need to be treated with prophylactic antibiotics to prevent a single case of dry socket.²²

The aetiology of dry socket is related to systemic factors, localized infection and surgical trauma. Antibiotics are only recommended in the presence of spreading infection.²⁵

Reimplantation of teeth

Trauma guidelines advise the prescription of antibiotics when reimplanting an avulsed tooth. However scientific evidence does not conclude that this increases the treatment rate of success.²⁶

Antimicrobial Prophylaxis for medically compromised patients

Historically antibiotics were prescribed to prevent bacteraemias and metastatic infections resulting from dental procedures. The British Society of Antimicrobial Chemotherapy (BSAC) and the National Institute for Health and Clinical

Excellence(NICE) have reviewed the evidence for bacteraemias in relation to cardiac patients. They concluded that the chances of developing a bacteraemia is greater from chewing and toothbrushing than from dental treatments.²⁷

The NICE guidelines state that there is no requirement to prescribe antibiotics for patients with acquired or congenital endocardial disease.²⁸ Likewise for patients with total joint replacements the BSAC found no evidence to support antibiotics prophylaxis when dental treatment is required.²⁹

Evidence indicates that even if antibiotic prophylaxis was 100% effective, it might only help prevent a very small number of IE cases.³⁰ Side effects of antibiotics include diarrhea, allergy, gastrointestinal upset and a potentially fatal anaphylactic reaction. However the incidence of fatal anaphylactic reactions was found to be extremely low where a single dose of oral amoxicillin is concerned. Over a 50 year period the AHA is unaware of any cases of fatal anaphylaxis resulting from the administration of penicillin recommended in their guidelines.³⁰ To date there is only one documented case of a fatal anaphylaxis in the GlaxoSmithKline Global records.³¹

However amidst the backdrop of universally conflicting arguments NICE has recently announced that it is to immediately review its 2008 guidelines following new research published at a meeting of the American Heart Association in Chicago in November 2014. The new research suggests that the number of people developing IE in the UK has increased following the publication of the NICE guidelines.³² This raises the concern that despite a lack of supporting evidence for antibiotic prophylaxis perhaps the total abolition of cover may have been a step too far? The need for more randomized prospective research is clear.

Immunocompromised Patients

There is no definitive evidence that the routine use of prophylactic antibiotics is advisable in patients with the following conditions:³³

- Leukaemia, immunosuppressive drugs following organ transplantation, lymphoma, anti-cancer chemotherapy, poorly controlled diabetes and HIV

Treatment should be carried out after correspondence with that patient's specialist.

Bisphosphonate –related Osteonecrosis of the Jaw

The scientific evidence does not support the routine administration of antibiotics in this patient cohort undergoing dental procedures.³⁴

Radiotherapy

Patients with a history of radiotherapy for head and neck cancer are at a very high risk of developing osteoradionecrosis (ORN) following even straightforward extractions or biopsies.³⁵ The most suitable antimicrobial regime is controversial. A recent survey of oral and maxillofacial consultants in the UK showed wide variation in practice. Most were in favour of pre-operative antimicrobial use for the surgical removal of lower posterior teeth and 89% advised a post-operative antibiotic course. Much of the controversy surrounds the microbial involvement in the pathogenesis of ORN, which is still unclear.³⁶

If a tooth is of hopeless prognosis then advice on management should be attained from a maxillofacial surgeon. The risk of osteonecrosis of the jaw is high in this patient cohort and increases with time. Poor blood flow and tissue penetration in the irradiated site make the use of antimicrobials debatable.³⁷

Surgical Endodontics

Where surgical endodontics is concerned a recent systematic review highlighted that prophylactic antibiotics to prevent systemic disease are not always in the patients best interests.²⁸ Similarly, prophylactic administration to prevent post-operative infection has not been shown to be advantageous.³⁸ Antibiotics should only be prescribed where signs of systemic involvement exist with lymphadenopathy and pyrexia, along with appropriate surgical drainage if required.³⁹ The RCS Surgical Endodontic Guidelines recommend preoperative and postoperative chlorhexidine mouthwashes as being the best method of preventing infections.⁴⁰

Therefore the only indications for antibiotic therapy in surgical endodontics include infections with:

- Gross local spread
- Systemic involvement
- Where treatment must be delayed or in cases where drainage is impossible and periapical surgery is needed

Evidence concludes that postoperatively antibiotics do not decrease swelling, percussion pain or the amount of analgesics needed to alleviate symptoms.^{41 42}

Dental Implant Placement

There is very limited evidence to support the use of routine prophylactic antimicrobials in implant therapy. Where good asepsis is absent it has been proven that antimicrobials are ineffective.⁴³ A meta-analysis however, recommends the following protocol to reduce the failure of implants:

- Amoxicillin 2g one hour preoperatively
- Patients allergic to penicillin: Clindamycin 600mg one hour preoperatively

Prophylactic antibiotics given orally one hour preoperatively seem to reduce early dental implant failure however no differences in postoperative infections have been observed by some authors.⁴⁴ However it is considered good practice to recommend antibiotics where immediate implants are placed into extraction sockets.⁴⁵ The use of prophylactic antibiotics are indicated for patients at risk of endocarditis, with immunodeficiencies, metabolic diseases, irradiated in the head and neck and when extensive and prolonged surgery is expected.⁴⁶ Some protocols advise short-term prophylaxis such as 2g Amoxicillin taken one hour before surgery and 500mg amoxicillin taken four times a day for 1 day. Prophylaxis should not be extended beyond the first three postoperative days since it does not appear to result in additional protection.⁴⁷

Antibiotic perioperative prophylaxis is advised for all patients if intraoral bone grafting is necessary prior to dental implant placement, even though there are no studies with high level evidence to support this. It appears that the risk of infection with implants is less when preoperative and postoperative antibiotics are prescribed.^{48 49 50}

Oroantral Communications and Fistulae

This post-extraction complication can be the result of procedures by the operator or if the patient inadequately follows post-operative instructions.

Successful treatment involves primary closure if there is no infection present and the following prescription of antibiotics is recommended⁵¹

- Amoxicillin 500mg three times daily for up to 5 days³⁸
- Doxycycline 200mg stat followed by 100mg daily for 5 days

Maxillofacial Fractures

Prophylactic antibiotics in the treatment of compound mandibular fractures have been shown to reduce the incidence of postoperative infection to 6% compared with 50% in patients not receiving prophylactic antibiotics.⁵² Currently there is no data supporting the use of postoperative antibiotics.⁵³

The efficacy of prophylactic antibiotics in the management of craniofacial fractures remains highly controversial. A systematic review advises perioperative antibiotics in all facial thirds and preoperative antibiotics in comminuted mandibular fractures. Postoperative antibiotics were not recommended in any facial third.⁵⁴

Dental Prescribing by Practitioners outside the dental profession

In the case of 'out-of-hours' patients often consult their GP before their dentist. GP's are more likely to prescribe antibiotics than dentists for acute dental problems.⁵⁵ Therefore where oral infections are concerned, antibiotic prescribing is not exclusive to dentists. Other healthcare professionals also contribute to the threat of antibiotic resistance. More comprehensive undergraduate and postgraduate education on responsible prescribing is required.

Use of Microbiology Laboratories by the Dental Profession

Diagnostic microbiology laboratories are an excellent resource for helping dentists with therapeutic decisions. Yet within the profession bacteriological sampling mostly occurs when empirical therapy has proven unsuccessful.⁵⁶ Evidence of inappropriate prescribing within the dental profession indicates that the facility is grossly underused.⁵⁷ Diagnostic microbiology laboratories can also assist in resistance surveillance and the development of local policies and guidelines.⁵⁸

Antibiotic Audits

It is clear that more audits of antibiotic prescribing practice are needed. These help to ascertain the number of prescriptions written, their appropriateness and also highlight areas of prescribing knowledge lacking in dental practice. Within clinical practice, audits have been shown to positively encourage appropriate prescribing patterns.⁵⁹ However it must also be understood that prescriptions are an indirect measure of antibiotic consumption and do not precisely calculate the rate of emerging resistance which is multifactorial.⁶⁰

The General Dental Council in the UK have outlined Responsible Prescribing Standards. These state that a drug should only be prescribed when appropriate. In recent years the GDC have reprimanded an increasing number of dentists regarding inappropriate antibiotic

prescribing such as giving a prescription without seeing the patient, not checking for allergies and failing to initiate drainage as the first line of treatment.⁶¹

Are we taking the problem seriously enough in dentistry?

Every year on the 18th November, European Antibiotic Awareness Day aims to increase knowledge amongst patients and healthcare professionals about antibiotic resistance.⁶² The Thunderclap Initiative also coincides with this date to harness individual's social media networks to help spread the message that 'infection needs drainage before considering antibiotics'.⁶³

It is critically important that the dental profession enforce antibiotic stewardship programmes.⁶⁴ Currently in Ireland there are no national legislative or regulatory mandates optimising the use of antibiotics through stewardship programmes. There is also no national surveillance system to determine the extent of resistance and to monitor the use of antibiotics.⁶⁵

With regards to patient compliance the dental profession could show leadership by encouraging patients to return uncompleted antibiotic courses to them. Currently government ministers have no official policy on this. More controlled disposal of antibiotics could prevent their release into the environment where they may have deleterious effects on environmental microbes by selecting for more resistance. Perhaps in the future the Irish Dental Association could find a mechanism of destruction for these unwanted antibiotics.

Antibiotic resistance is a real and imminent threat to the health and well-being of the nation and indeed the global community. Action is urgently needed to slow resistance by pledging to cut antibiotic overuse. As a profession we have a duty of care to follow the 'path of least resistance' in protecting this life-saving medicine.

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