Antibiotic resistance – A growing dental problem

Graham Cope and Anwen Cope discuss the growing problem of antibiotic resistant bacteria and how the dental industry can help limit the resistance.

The emergence and spread of antibiotic resistant bacteria is a significant threat to worldwide public health. Since their introduction in the 1940s antibiotics have saved millions of lives, curing bacterial infections that would have previously proved fatal. However, soon after their introduction it became clear that some bacteria were naturally resistant to these chemicals. The recent increase in antibiotic resistance, such as MRSA (methicillin-resistant staphylococcus aureus) and VRE (vancomycin-resistant enterococci) may be due to selective pressures applied by inappropriate prescribing and non-adherence to the recommended treatment programmes.

Resistance to antibiotics in normally susceptible bacteria is due to mutations and changes to their physical or genetic characteristics, such as the acquisition of new enzymes or proteins. The genes responsible for these changes are usually located on the plasmid, a small circular form of helical DNA, that is capable of transferring from one bacterium to another, thus facilitating the spread of resistance between different types of bacteria (Byarugaba, 2009).

The clinical impact of the increasing antibiotic resistance is that patients suffering from infections previously easily treated with antibiotics are becoming harder to cure, requiring longer courses of less effective and more costly antibiotics. When this is combined with the slow rate new antibiotics are being brought to market, there are concerns that we risk returning to the pre-antibiotic age, when relatively common infections will once again be fatal.

One of the major factors that contribute to antibiotic resistance is the inappropriate prescribing of antibiotics in primary care, and importantly, efforts to reduce antibiotic dispensing at general-practice level has also been shown to reduce local antibiotic resistance (Butler et al, 2007).

Antibiotic use in dentistry

In dental practise, antibiotic resistant bacteria are increasingly being isolated from dentoalveolar dental abscesses, and studies have demonstrated a correlation between the presence of these resistant bacteria and prior use of antibiotics for dental infections (Kuriyama et al, 2006) (Kuriyama et al, 2000). Whilst the presence of penicillin-resistant bacteria within a dental abscess has not yet been demonstrated, the prescription of systemic antibiotics for dental problems exerts a selective pressure on bacteria throughout the body, which may theoretically contribute to the prevalence of antibiotic resistance amongst bacteria implicated in pneumonia, bacterial meningitis and upper respiratory tract infections.

Dental practitioners are responsible for almost 10% of all community antibiotic prescriptions in England and Wales (Karki, Holyfield and Thomas, 2011) (Health and Social Care Information Centre, 2013). The vast majority of these antibiotics are penicillins (amoxicillin, penicillin V and co-amoxiclav) or metronidazole, although there are often wide variations in the dose, frequency and duration of course prescribed by dentists (Palmer et al, 2000).

Antibiotics are mainly prescribed for acute dental conditions, such as symptomatic apical periodontitis.
and acute apical abscesses, despite clinical guidelines that recommend the first-line of treatment for these conditions should be primarily based on physical measures such as dental extraction, pulpal incision and drainage of a swelling. Antibiotics are not indicated in the management of infections in the absence of spreading infection and systemic upset in healthy individuals (SDCEP, 2011). Furthermore, many acute dental conditions, such as pulpitis, are inflammatory in nature, and therefore antibiotics are likely to confer little to no clinical benefit. Indeed, a recent Cochrane Systematic Review concluded that antibiotics had no significant effect in patient-reported pain between groups of patients with irreversible pulpitis, compared to placebo treated controls (Keenan et al., 2005).

Despite this there is evidence that antibiotics are still being routinely prescribed for acute dental conditions in situations where they are unlikely to be of clinical benefit. In a retrospective analysis of clinical records one study reported that over 50% of patients attending an out-of-hours clinic received antibiotics as their only treatment. Furthermore, many antibiotics were provided for conditions that can be effectively managed by local measures, such as apical periodontitis and dry socket (Tulip and Palmer, 2008). Other studies also suggest that antibiotics are being used as a substitute for local measures in emergency appointments (Dailey and Martin, 2001). This inappropriate use of antibiotics, in addition to intensifying resistance, wastes resources, exposes patients to side effects and encourages patient expectations of antibiotics for dental problems in the future (Butler et al., 2012).

Inappropriate prescribing within dentistry

Relatively little is known about why dentists prescribe antibiotics in situations where they are not recommended by clinical guidelines. However, research suggests that time or workload pressures and situations where there is uncertainty of diagnosis may have significant impact on prescribing behaviours of dentists (Palmer et al., 2000). Furthermore, it is likely that some inappropriate prescribing may occur in response to patient expectation or request for antibiotics. Despite immense media coverage about ‘superbugs’, MRSA and C. diff (Clostridium Difficile), many patients still feel let down if they do not get a prescription for antibiotics for an infection, irrespective of the seriousness or potential duration (Costelloe et al., 2012).

Improved education

Education is the key approach to improve patients’ satisfaction and willingness to accept surgical measures as their only treatment, rather than get a prescription for antibiotics for an acute dental condition. Encouragingly, there is evidence to suggest that only 3% of patients who expect, but do not receive an antibiotic for a dental problem, are dissatisfied with the dentist’s decision (Seager et al., 2006). Good communication of the relative benefits and risk of both physical and pharmacological treatment options will often alleviate a patient’s expectations of antibiotics.

Interventions are also required to optimise antibiotic prescribing amongst dental professionals. In the past both clinical audit and pharmacist-led educational courses have resulted in improved prescribing behaviours (Seager et al., 2006) (Palmer, Dailey and Martin, 2001). However, it is often unclear whether practitioners maintain this change in prescribing practices long-term.

Duration of therapy

A prescription for antibiotics is necessary for certain odontogenic infections, especially if there are signs of spreading infection or systemic involvement. In these situations patients are generally prescribed a course of antibiotics of five to seven days in duration (Palmer et al., 2000). However, research suggests that the duration of antibiotic therapy in most patients with acute dentoalveolar infections can safely be two to three days, provided that drainage has been established (Martin et al., 1997). In a recent audit, conducted at Bristol Dental Hospital, following drainage and removal of the source of infection, a three-day standard dose antibiotic regimen was effective in the management of the acute apical abscess in all reviewed patients showing associated signs of systemic symptoms (Ellison, 2011).

Conclusions

The resistance of pathogenic bacteria is a natural phenomenon, but is made worse by frequent exposure to suboptimal and unnecessary antibiotics. If current prescribing practices remain unchanged then strains of bacteria will continue to emerge. Therefore, dental healthcare professionals should always attempt local, operative measures when faced with odontogenic infections, and only prescribe antibiotics in situations of spreading infection or systemic involvement (Cope, Chestnutt and Francis, 2013).

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