

SYSTEMIC ANTIBIOTICS IN ENDODONTIC PRACTICE: MANDATORY OR, OPTIONAL

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ABSTRACT

Antibiotics are life-saving adjuncts to the armamentarium available to health professionals for management of a plethora of infections. In endodontic treatment and trauma cases, antibiotics are prescribed systemically in the form of either oral and/or, parenteral drugs. Systemic antibiotics are routinely used during treatment of acute and chronic odontogenic infections, oral non-odontogenic infections, as prophylactic treatment against focal infections and infections spreading to the neighbouring tissues and organs. In endodontics, systemic antibiotics have a special role since complete eradication of infection from the root canal is difficult owing to the complex anatomy of the root canals and also, in cases of infections extending into the peri-apical region which eventually result in endodontic flare-ups and failure of endodontic treatment. Antibiotics are, also, commonly given as a life saving drugs in immuno-compromised patients with obvious clinical advantages, in patients suffering with infective endocarditis, septicaemia, pyemia, diabetes mellitus and also, in patients receiving radio-chemo-therapies and patients having prosthetic heart valves. This review comprehensively discusses the role of systemic antibiotics in treatment of endodontic emergencies and promoting healing of the peri-apical infections.

Key Words: Antibiotics, infections, odontogenic, diabetes mellitus, endodontic flare-ups and failure, bacteremia

INTRODUCTION

Micro-organisms and their by-products are the main etiologic factors causing progression and persistence of infection in the root canal and the surrounding peri-apical tissues. Elimination of these micro-organisms from the complex inaccessible anatomy of the root canal system is often difficult by mechanical instrumentation alone. This commonly causes re-infection of the root canal and failure of the endodontic treatment. Hence, systemic antibiotics are needed to be prescribed in adult and pediatric patients in various conditions including acute and chronic odontogenic infections as prophylactic measure to control bacteremia and chances of reinfection.^{1,2} Endodontic infections are largely poly-microbial and mixed in nature with predominance of anaerobic bacteria found in all the infections

related to oral cavity. In cases of acute infections, systemic antibiotics have proven to be effective in controlling bacteremia and preventing further complications such as fever and malaise. In chronic lesions involving the peri-apical region, the triad of root canal instrumentation along with intra-canal medication and administration of systemic antibiotics are highly effective in giving success to the prognosis of the endodontic treatment procedure. Hence, systemic antibiotics are prescribed as an adjunctive treatment of odontogenic infections.³⁻⁵

HISTORY

Antibiotics were first discovered in the year 1928 but were clinically used first during the Second World War (Abott, 2000). Antibiotics became popular since there was rapid recovery of wounded military personnel during the war. The first use of antibiotics in endodontics was introduced in the year 1951 by Grossman as a poly-antibiotic paste known as PBSC (Mixture of penicillin, bacitracin, streptomycin and caprylate sodium) with penicillin being effective against the gram positive organisms, bacitracin against the

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penicillin resistant strains, streptomycin against the gram negative organisms and caprylate sodium against yeasts. Later, caprylate sodium was replaced by nystatin as an important anti-fungal agent.^{3,6,7} Flare-ups in endodontics are caused by various factors such as microbial factors (including gram negative anaerobic micro-organisms namely *Bacteroides melaninogenicus*), changes in peri-apical tissue pressure, cell mediators like histamine, serotonin, prostaglandins and leukotrienes, plasma factors including Hageman factor, immunoglobulins like IgG, IgM and IgA and psychological factors with fear, anxiety and previous experiences further worsening the situation and the patient's response to infections as well as treatment.^{8,9} Antibiotics have, also, been used during regenerative procedures for disinfection of the root canal. The most commonly used antibiotic is Triple Antibiotic Paste containing metronidazole, ciprofloxacin and minocycline in the ratio 1:1:1.¹⁰

Role of Systemic Antibiotics in Odontogenic Infections:

Systemic antibiotics are routinely administered in acute odontogenic infections including acute dento-alveolar abscesses where there is diffuse spreading infection and systemic manifestations. Biomechanical preparation alone is often insufficient to eradicate the infection from the root canal space and the surrounding tissues. Also, in medically compromised patients, the host-defence mechanisms are thought to be inadequate and in patients receiving medications like corticosteroids and anti-metabolites or, in cases of systemic diseases like leukemia, HIV, neutropenia, splenectomy, lupus erythematosus, poorly controlled diabetes mellitus and organ transplants patients.¹¹⁻¹³ Hence, in such conditions, therapeutic dosages of systemic antibiotics becomes mandatory. Systemic antibiotics are, also, indicated in patients with cardiac problems associated with endocarditis following dental treatments. Bacteremia can occur following invasive dental treatment procedures giving rise to shunt and/or, vascular catheter colonization which requires immediate attention by prescription of systemic antibiotics.¹⁴⁻¹⁶ These have, also, been proven to reduce post-operative pain and swelling

The common prophylactic antibiotic regimens are as follows:⁷

Medical status and endodontic procedure	No penicillin allergy	In case of penicillin allergy
Healthy (1) Re-implantation of avulsed teeth	1) 1gm cephradine orally, 1-1.5hr pre-operatively	(1) 600mg Clindamycin ^a orally 1hr pre-operatively
2) Endodontic surgeries (if prophylaxis indicated)	2) 3gm amoxicillin orally, 1hr pre-operatively	(2) 600mg Clindamycin ^a orally 1hr pre-operatively
Endocardial disease: Determination of root canal length, apicectomy, root resection, repair of root perforation, root planing, extractions, biopsy, incision and drainage, re-implantation of avulsed teeth, re-positioning of displaced teeth	3gm amoxicillin orally, 1hr pre-operatively	600mg Clindamycin ^a orally 1hr pre-operatively
Immuno-compromised: Chemoprophylaxis is only required for exodontias, root planing and endodontic surgeries	If special risk, follow BSAC recommendations.	If special risk ^b , follow BSAC recommendations.
Artificial joint replacement cases: Chemoprophylaxis is only required for exodontias, root planing and endodontic surgeries	3gm amoxicillin orally, 1hr pre-operatively	600mg Clindamycin ^a orally 1hr pre-operatively
Susceptible to osteoradionecrosis: Exodontias and endodontic surgeries	1gm cephradine orally, 1-1.5hr pre-operatively and 200mg metronidazole orally, post-operatively three times a day for 3 consecutive days	600mg Clindamycin ^a orally 1hr pre-operatively and 200mg metronidazole orally, post-operatively three times a day for 3 consecutive days

seen during flare-ups following biomechanical preparation of the root canal during endodontic treatment. Anecdotal evidence, also, suggests that administration of systemic antibiotics should be done along with repeated inter-appointment change of intra-canal medicament dressings since pus continues to remain in the complex root canal system. Furthermore, systemic antibiotics should be mandatorily prescribed after single visit endodontics to prevent flare-ups. Systemic antibiotics such as tetracycline or, metronidazole have been found useful in treating periodontal infections and can, also, be used as an adjunct to invasive root planing procedures. Triple antibiotic paste consisting of ciprofloxacin, metronidazole and minocycline in the ratio 1:1:1 has been effective in disinfection of traumatized immature teeth during re-vascularisation procedures.¹⁷⁻²¹

^a Patients who have been given Clindamycin must be advised to consult their doctor if diarrhoea develops. Clindamycin tablets should be swallowed with a glass of water to prevent oesophageal irritation.

^b Special risk patients. The British Society of Anti-microbial Chemotherapy (BSAC) has recognised a group of patients with endocardial disease who they consider as "special risk", particularly, susceptible to infective endocarditis (IE). Special risk patients are classified as those patients with endocardial disease who: (i) have had IE before or; (ii) require a general anaesthetic and/or, (a) have a prosthetic heart valve or; (b) are allergic to penicillin or, have had penicillin more than once in the previous month. Such "special risk" patients are normally considered for medical supervision for dental treatments requiring prophylaxis.

DISCUSSION

Disinfection of the root canal system plays a pivotal role in the success of endodontic treatment

and in promoting the healing of the peri-apical tissues. It primarily involves cleaning and shaping of the canal spaces with appropriate endodontic instruments, proper irrigation to dissolve the necrotic pulpal remnants and to flush-out the debris and the toxins present in them and placement of appropriate inert substitutes and medicaments. Prescription of systemic antibiotics should always be done as an adjunct to appropriate clinical treatment.³⁻⁶ Systemic antibiotics are recommended especially in cases of acute and chronic odontogenic infections and in patients with specific systemic involvement and with special risk of developing bacteremia. In cases of systemic involvement like fever, malaise, toxemia, in patients with progressive infections, endocarditis and in patients with immunocompromised status, systemic antibiotics are particularly useful for a faster recovery of the patients. In cases with complicated and/or, disseminated odontogenic infections with systemic complications such as fever, malaise and lymphadenopathy, cellulitis, trismus, in cases of progressive diffuse swelling and bacteremia in immunocompromised patients, empirical therapy with systemic antibiotics becomes mandatory along with appropriate surgical options.¹⁴⁻¹⁷ Endodontic infections are usually poly-microbial in nature. Selection of an antibiotic regimen should be based on the knowledge of the efficacy of a particular antibiotic for the bacteria most often associated with severe infections. The most commonly associated micro-organisms in endodontic infections include obligate anaerobes, bacteroides, fusobacterium, peptostreptococcus, actinomyces, eubacterium and propionibacterium. Endodontic infections serve as biological ecosystems where the by-products of one species of bacteria serve as nutrients for another species. The choice of a particular antibiotic is based on the culture and sensitivity testing.²³⁻²⁵ Various systemic antibiotics used to treat odontogenic infections

Antibiotic prophylaxis against bacterial endocarditis in oral procedures (AHA):²²

Antibiotic	Indication	Dose	Timing
Amoxicillin	Standard	2g po, *50mg/kg po	1 hour before
Ampicillin	If oral route cannot be used	2g im or, iv, *50mg im or, iv	½ hour before
Clindamycin	Allergy to penicillin Allergy to penicillin and if oral route cannot be used	600mg po, *20mg/kg 600mg po or, iv, *20mg/kg iv	1 hour before ½ hour before
Cephalexin or, Cefadroxil	Allergy to penicillin	2g po, *50mg/kg po	1 hour before
Azithromycin or, Clarithromycin	Allergy to penicillin	500mg po, *15mg/kg po	1 hour before
Cefazolin	Allergy to penicillin and if oral route cannot be used	1g im or, iv, *25mg/kg	½ hour before

include penicillin, clindamycin, erythromycin, cefadroxil, metronidazole and tetracyclines. Penicillin V has remained the gold standard antibiotic since its advent as it is effective against various facultative and strict anaerobes found in endodontic infections and is low in toxicity. In cases of unresolved infections and in immunocompromised patients, amoxicillin plus clavulanic acid having higher anti-bacterial effectiveness is recommended.²¹ Metronidazole is given in combination with penicillin to control the anaerobic bacterial spectrums. Clindamycin is recommended in cases of serious odontogenic infections including β -lactamase producing microorganisms where penicillin has failed and/or, is contraindicated due to penicillin allergy. Erythromycin is, also, indicated in cases with patients allergic to penicillin therapy. Clarithromycin and Azithromycin are the newer generation macrolides used as an alternative to erythromycin since they are effective against facultative and anaerobic bacteria resistant to erythromycin. Cefadroxil is another adjunct used along with other antibiotics to provide a broad spectrum of antibacterial action. Tetracyclines, in vogue, in the past, have limited utility these days since they have been largely replaced with better and more effective antibiotics and because of their associated adverse effects which make them especially restricted in their usage in pregnant and/or, nursing females and children under 8 years of age.^{2,26}

CONCLUSION

To conclude, antibiotics are life-saving adjuncts to the armamentarium available to health professionals for management of a plethora of infections. Their appropriate use in specific situations especially in patients who are immunocompromised and at risk of developing bacteremia, systemic antibiotics serve a highly useful role in preventing the further dissemination of infections and risk of developing complications. Their use, however, requires an adequate knowledge of the clinician, evaluation of medical history of the patients and appropriate culture and sensitivity tests indicated in cases with flare-ups and failures and in cases which are resistant to conventional therapeutic options and become recalcitrant to routine treatments.

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