EUROPEAN ACADEMY OF PAEDIATRIC DENTISTRY (EAPD)

POLICY DOCUMENT FOR THE USE OF ANTIBIOTICS IN PAEDIATRIC DENTISTRY (2002)

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Adopted in 6th EAPD Congress in Dublin, June 15th – 17th 2002

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INTRODUCTION

In recent years there has been an increasing tendency to reduce the widespread use of antibiotics for prophylactic and therapeutic purposes. This is based, both on increasing scientific evidence and enhanced professional experience. The development of resistant strains of micro-organisms, doubt on the efficacy of the proposed prophylactic regimens, possible toxic and adverse reactions to antibiotics and poor compliance by patients and dentists raised questions about risks and benefits.
There clearly is a trend towards covering only a limited number of invasive dental procedures and this in fewer and more specific medical conditions.
Today there is no clear consensus among experts on the use of antibiotics in dentistry. This is because scientific evidence for the indications is often lacking.
Different national and international protocols are available and these are regularly updated. Dental practitioners should know the protocol to be applied in their patients and should apply the most recent (national) guidelines but most importantly, it should be remembered that the recommendations presented here or in other protocols are not intended to replace clinical judgement.

In dentistry, antibiotics are used mainly in the following purposes:
(1) as adjuncts to therapy of orofacial infection
(2) to prevent local infection associated with dental procedures
(3) to prevent the spread of oral micro-organisms to susceptible sites elsewhere in the body

ANTIBIOTICS AS ADJUNCTS TO TREATMENT OF ODONTOGENIC INFECTION

Nature of odontogenic infections in children

Most acute orofacial infections are of odontogenic origin and the majority of them are self-limiting, and may drain spontaneously. The treatment of infection follows two basic tenets: removal of a cause and local drainage and debridement. Early recognition and management of acute orofacial infection and careful follow-up of the resolution of the infection is critical, because pediatric patients may become systematically ill within a short period of time (Dodson et al 1989, Sandor et al 2000). If left untreated the local infections may lead to spread of infection to an upper or a lower face. Airway obstruction may occur in case of lower face infections.

Microbiology of odontogenic infections

The bacteria that cause odontogenic infections are usually part of the indigenous bacteria. The microbiology is characteristically mixed with multiple organisms, with different characteristics (Peterson 1998, Sandor et al., 1998). Both anaerobic and aerobic bacteria are commonly present. The aerobic bacteria that cause odontogenic infections consist of many species, the most common of them being streptococci. The anaerobic bacteria that cause infections include even a greater variety of species. Two main groups, however, dominate. Those are gram-positive cocci (Streptococci and Peptostreptococcus) and gram-negative rods (Bacteroides spp., Fusobacterium spp.)

Selection of an antibiotic

The orally administered antibiotics that are effective against odontogenic infections include penicillin, clindamycin, erythromycin, cefadroxil, medronidazole, and the tetracyclines (Peterson 1998, Walker 1992). These antibiotics are effective against streptococci (except metronidazole) and oral anaerobes. Phenoxymethylpenicillin (penicillin V) is the penicillin of choice for odontogenic infections. It is bactericidal and although its spectrum is relatively narrow, it is appropriate for the treatment of odontogenic infections. For the prophylaxis against the endocarditis associated with dental procedures, amoxicillin is the first choice antibiotic. Amoxicillin-clavulanate may be used in selective cases since it has an advantage that it retains activity against β-

lactamase producing organisms commonly associated with odontogenic infections.

An alternative drug for use in penicillin-allergic patient is clindamycin. It is also bacteriostatic, but bactericidal activity is achieved clinically with the usual recommended doses. The newer macrolides, clarithromycin and azithromycin may also be used if the child is allergic to penicillin. The cephalosporin cefadroxil may be a useful drug when a broader antibacterial spectrum is necessary. Metronidatzole is useful only against anaerobic bacteria and should be reserved for situations in which only anaerobic bacteria are suspected. Tetracyclines are of limited use in dentistry. As tetracyclines may cause discoloration of teeth they should not be given to children below 8, pregnant women and lactating mothers.

When are antibiotics needed in the management of an odontogenic infection?

In considering the use of antibiotics in paediatric dentistry the clinician has to consider such things as:

- How serious is the infection when the child comes to the dentist?
- What is the state of the patient's host defences? A healthy child may be able to mobilize host defences and need less antibiotic therapy for resolution of the infection. On the other hand, children who are immunocompromised, may require vigorous antibiotic therapy for even minor infections.

When these factors are balanced, the following indications for the use of antibiotics come up.

- In case of acute infection, if the infection has a modest swelling, has progressed rapidly, is a diffuse cellulitis with moderate-to-severe pain, or the child has fever (Epstein 2000, Dodson et al 1989, Peterson 1998, Schröder, 2001) the evidence would support the use of antibiotics in addition to treatment of the offending tooth.
- Infection of almost any type or severity in a child who is medically compromised.
- Presence of infection that has progressed to extraoral fascial spaces. In these situations the infection is aggressive enough to have spread beyond the mouth, indicating that the host defences are inadequate to contain the infection. In the severe cases the child should be hospitalized.
- Osteomyelitis
- Antibiotics are seldom needed for trauma, but in cases with significant soft-tissue or dentoalveolar injuries they are indicated as a prophylaxis against infection. Antibiotic coverage should also be given when an

avulsed tooth is replanted, since the use of systemic antibiotics may decrease the incidence of external root resorption (Andreasen et al. 2000, Sae-Lim et al, 1998).

- Patients with localized juvenile periodontitis and other types of early-onset periodontitis may be considered for antibiotic therapy, although randomized controlled trials to support this view are missing (van Winkelhoff et al. 1996, Ellen and McCulloch 1996).

Antibiotic therapy would not be indicated or is even contraindicated in other situations such as:

- Presence of minor, chronic, well-localized abscess. In an otherwise healthy child often the extraction of the abscessed primary tooth alone or root-canal therapy for a permanent tooth (if it is considered important to save) will bring about resolution without antibiotic therapy. Contrary to healthy children, immunosuppressed patients, or those with cardiac disease, may need antibiotics even if infection is only suspected.
- Presence of a very well-localized vestibular abscess, with little or no facial swelling.

Duration of antibiotic therapy of an odontogenic infection

The ideal duration of antibiotic therapy is the shortest that will prevent both clinical and microbiological relapse (Norrby 1991). Clinical judgement must be applied, but most acute odontogenic infections resolve in three to seven days (Dodson et al 1989, Pallasch 1996). When using antibiotics orally, loading doses should be considered to achieve therapeutic levels more rapidly (Pallasch, 1996). The only practical guide for determining the effectiveness of antimicrobial treatment, and hence the duration of therapy, is clinical improvement of the patient as judged by remission of the infection (Leitman 1990). When the clinical evidence indicates that the infection is reasonably certain to resolve or is resolved, the antibiotic therapy should be terminated (Pallasch 1996).

PREVENTION OF LOCAL INFECTION ASSOCIATED WITH DENTAL PROCEDURES

Surgical interventions in the mouth are performed in clean-contaminated circumstances.
It has been shown that wound infection rates after dental extractions, third molar surgery and orthognatic surgery are lower than 1% (Peterson, 1990).

Therefore antibiotic prophylaxis is not indicated in these situations unless the immune system of the patient is compromised.
Whether the prophylactic use of antibiotics is justified in healthy patients in situations where the surgical site is highly contaminated with micro-organisms (eg in periodontal surgery) remains controversial (Tong & Rothwell, 2000). Also, extraction of several teeth under general anaesthesia has been found to cause postoperative temperature elevation possible because of bacteremia. The use of antibiotics may be justified although the need is controversial (Vinckier et al., 2001, Holan et al., 1993).
A factor that may suggest the use of antibiotics is the insertion or presence of foreign body, most commonly dental implants. Most data seem to suggest that the use of antibiotics may decrease the incidence of infection when foreign bodies, such as dental implants , are inserted into jaws.
Autotransplantation of teeth is usually performed under antibiotic prohylaxis. In this situation antibiotics are administered in order to reduce the incidence of root resorption (Meechan JG, 1997).
When prophylactic antibiotics are used to prevent local wound infection, the antibiotic level in the plasma must be higher than when therapeutic antibiotics are used. The usual recommendation for prophylaxis is that the drug be given in a dosage at least 2 times the usual therapeutic dosage before the surgery begins (Peterson 1998). Unless the surgery is prolonged a single dose is recommended.

PREVENTION OF THE SPREAD OF ORAL MICRO-ORGANISMS TO SUSCEPTIBLE SITES ELSEWHERE IN THE BODY

Dental bacteraemia in children

Bacteraemia following dental procedures

Several studies evaluated the prevalence and the extent of bacteraemia after different dental procedures, also in children. It is shown that tooth-brushing alone is associated with bacteraemia in more than one third of the children (Roberts et al, 1997). Polishing and cleaning of teeth results in a bacteraemia in a significant number of children (Martin et al, 1997 ; Roberts et al, 1997). This is also the case for different conservative dentistry procedures, such as rubber dam placement and positioning of matrix band and wedges (Roberts et al, 2000) and for orthodontic procedures such as the placement and removal of orthodontic bands (Khurana & Martin, 1999).
Single tooth extraction results in bacteraemia in 40 to 50% of the children examined (Roberts et al, 1997). Highest levels of bacteremia are found after

intraligamental injection of local aneasthetic (96.6% of the children) (Roberts et al, 1998b).
In more than 50% of the cases viridans streptococci are isolated (Roberts et al, 1997).

Is there a link between bacteraemia and systemic complications?

The question whether significant bacteraemia following dental interventions justify the prophylactic administration of antibiotics, even in susceptible patients, remains unanswered (Roberts et al, 1999 ; Tong et al, 2000).
A recent paper showed that dental treatment was not a risk factor for the development of infective endocarditis (Strom et al, 1998). Bacteraemia following 'everyday' procedures like tooth-brushing appear to be equally or even more important (Roberts, 1999).
The level of oral hygiene influences bacteraemia levels considerably (Venugopalan & Worthing, 1998). For this reason, optimal oral hygiene could be more important in the prevention of complications as a consequence of bacteremia than any antibiotic regimen (Guntheroth, 1984).

Antibiotic prophylaxis has been recommended in following situations:

- Patients at risk of developing infective endocarditis
- Patients with prosthetic joint replacement
- Patients with indwelling catheters, stents, shunts or implants
- Patients with compromised immune system

Prevention of infective endocarditis

What is infective endocarditis?

Infective endocarditis (previously acute/subacute bacterial endocarditis) is an inflammatory and proliferative alteration of endocardial structures (often heart valves) characterized by the formation of vegetations and caused by an infection with micro-organisms. The reaction arises from the colonisation of a pre-existing lesion where disruption of the endothelial lining occurred as a consequence of abnormal development, disease or presence of foreign bodies. Congenital and acquired cardiac defects and abnormalities predispose the heart to endothelial damage.
Infective endocarditis is a condition with high morbidity and considerable mortality.

Is prophylactic administration of antibiotics recommended?

Although there still is much debate about the cost-effectiveness of the procedure, antibiotic prophylaxis is administered in specific situations (procedures that are likely to induce bacteraemia) (see Table B) to patients at risk for this condition (see Table A).

Table A : Patients at risk of developing infective endocarditis
HIGH RISK • Prosthetic cardiac valves, including bioprosthetic and homograft valves • Previous bacterial endocarditis • Complex cyanotic congenital heart disease (eg transposition of great arteries, tetralogy of Fallot) • Surgically constructed systemic pulmonary shunts or conduits
MODERATE RISK • Most other congenital cardiac malformations (other than those above) • Acquired valvular dysfunction (eg rheumatic heart disease) • Hypertrophic cardiomyopathy • Mitral valve prolapse with valvular regurgitation and/or thickened leaflets
After American Medical Association, Dajani et al, 1997

Which patients do require antibiotic prophylaxis?

Table A summarizes patient categories were the administration of antibiotics for the prevention of infective endocarditis is recommended by American Heart Association (Dajani et al., 1997).
As a consequence of a more specific description of the conditions that pose significant risk for the development of infective endocarditis and a better delineation of low or negligible risk situations, fewer than before patients require antibiotic prophylaxis.

Some comments:

- Patients with physiologic heart murmur do not require antibiotic prohylaxis.
- It should be noted that a self-reported history of heart valve disease should not be the sole criterion (Guggenheimer et al, 1998)

- Patients with isolated secundum atrial septal defects do not require antibiotic prophylaxis.
- Patients with mitral valve prolapse need antibiotic coverage only when there is echocardiographic evidence of regurgitation.
- In case of corrective surgery for a patient with patent ductus arteriosus, antibiotic coverage is only required for the initial 6 months following surgery.
- Today there are insufficient data to support specific recommendations in cardiac transplant patients. It is recommended to consult the patient's cardiologist. It should be noted that these patients have reduced immune responses due to the immunosuppressive medication they take to prevent graft rejection (see also C5).

Which dental procedures require antibiotic prophylaxis?

There still is much controversy over which procedures do or do not require antibiotic prophylaxis. Table B summarizes most recent guidelines.

Table B : Dental procedures considered for antibiotic prophylaxis in patients at risk of infective endocarditis
• Dental extractions • Periodontal procedures including surgery, scaling, root planning and probing • Dental implant placement, reimplantation of teeth • Endodontic instrumentation or surgery beyond the tooth apex • Subgingival placement of antibiotic fibers or strips • Initial placement of orthodontic bands but not brackets • Intraligamentary local anaesthetic injections • Prophylactic cleaning of teeth or implants with anticipated bleeding
After American Medical Association, Dajani et al, 1997

Which protocol to use for antibiotic prophylaxis?

In recent years several changes were made to the most widely used protocols. These can be summarized as follows.
Intravenous administration has been replaced by oral administration, the oral dose has been reduced from 3 grams to 2 grams of amoxicillin (Dajani et al,

1997), the follow-up dose has been discontinued and erythromycin has been substituted by other antibiotics as alternatives for penicillin (Dajani et al, 1997).
It was shown that bacterial isolates recovered in cases of bacteraemia following oral surgical procedures in children are susceptible to most of the antibiotics recommended for antibiotic prophylaxis (Roberts et al, 1998a).
Whenever possible, sugar free preparations should be used when liquid medicines are prescribed in order to prevent the development of dental decay (Marathaki et al, 1995).
Table C describes recommended antibiotic regimens for the prevention of infective endocarditis in children.

Table C: Recommended antibiotic regimens in children (*)

SITUATION	ANTIBIOTIC	REGIMEN		
		Dose	**Route**	**Timing**
Standard	Amoxicillin	50 mg/kg bw (max 2 grams)	orally	1 hour before procedure
No oral intake	Ampicillin	50 mg/kg bw (max 2 grams)	IM or IV	30 min before procedure
Allergy to penicillin	Clindamycin	20 mg/kg bw (max 600 mg)	orally	1 hour before procedure
	Cephalexin** Cefadroxil**	50 mg/kg bw (max 2 grams)	orally	1 hour before procedure
	Azithromycin Clarithromycin	15 mg/kg bw (max 500 mg)	orally	1 hour before procedure
Allergy to penicillin and no oral intake	Clindamycin	15 mg/kg bw (max 600 mg)	IV	1 hour before procedure
	Cefazolin**	25 mg/kg bw (max 1 gram)	IM or IV	30 min before procedure

mg = milligram ; kg = kilogram ; bw = body weight ; IV = intravenous ; IM = intramuscular
* = total dose should not exceed adult dose
** = cephalosporins should not be used in children with immediate-type hypersensitivity to penicillins (urticaria, angioedema, anaphylaxis)

After American Medical Association, Dajani et al, 1997

Additional measures

- The maintenance of optimal oral hygiene is an extremely important additional measure (Venugopalan & Worthing, 1998; Khurana & Martin, 1999).
- The use of an oral rinse containing chlorhexidine 0.2% is effective in reducing the bacterial load in the oral cavity (Mc Farlane et al, 1984).
- Special attention should go to persistence of necrotic foci. In this respect prevention of any form of oral (dental) disease is utmost important in these patients.
- Fixed acrylic orthodontic appliances often harbor high levels of viridans streptococci. These appliances should not be used in high-risk patients.

  Removable appliances need to be cleaned regularly. Some authors advise daily rinsing with an antiseptic solution during orthodontic treatment of these patients (Brook & Gober, 1998; Tong et al, 2000).

Specific situations

- When several appointments are needed for invasive dental treatment (requiring the administration of antibiotics) in these patients, it is important to leave intervals between different appointments that are large enough in order to reduce the risk of overgrowth by penicillin-resistant micro-organisms in the oral cavity (9 to 14 days) or to prescribe an antibiotic from a different class (Erickson & Herzberg, 1999).
- Common antibiotic protocols applied in children for treating otitis media or sinusitis may create antibiotic resistant bacterial strains (oral streptococci). This may interfere with the efficacy of the use of the proposed antibiotic endocarditis prophylaxis protocols (amoxicillin) (Erickson & Herzberg, 1999). In these situations it is advised to switch to a different class of antibiotics for prophylactic purposes or to reschedule the appointment and postpone the invasive dental procedure at least until 9-14 days after stopping the intake of antibiotic medication.

Patients with prosthetic joint replacement

The routine use of antibiotic prophylaxis in patients with joint replacement has been discontinued recently (ADA and AAOS, 1997). This decision was based on the following: the extreme low incidence of late prosthetic joint infection associated with dental treatment (Jacobsen & Matthews, 1987) ; the high cost of

antibiotic prophylaxis and the risk of death caused by anaphylactic reaction to especially penicillins. Antibiotic coverage is now restricted to specific situations and patients (table D).

Table D: Antibiotic prophylaxis in patients with prosthetic joint replacement
Antibiotic prophylaxis is recommended in patients with : TOTAL joint replacement **AND** • compromised immune system • type 1 diabetes mellitus • recent joint replacement (< 2 years) • previous prosthetic joint infection • malnourishment • haemophilia After American Dental Association / American Academy of Orthopaedic Surgeons, 1997

Patients with indwelling catheters, stents, shunts or implants

Children with this type of foreign materials inserted may be in need of antibiotic coverage in some situations.

- Antibiotic prophylaxis is generally not necessary when catheters are present, unless the catheter is positioned near the right side of the heart (Pallash, 1997), or the catheter is used for prolonged periods and/or the administration of chemotherapeutic agents (Tong & Rothwell, 2000). In the latter situation, antibiotics are administered because of the suppressed immune status of the patient.
- In children with vascular stents, antibiotic coverage is recommended only in the first two weeks after the insertion of the stent. Once an epithelial lining developed, the risk of infection is minimal (Tong & Rothwell, 2000).
- Children with an arteriovenous shunt (but not peritoneal shunt) for renal dialysis are placed in need of antibiotic prophylaxis in case of bacteraemia-inducing (dental) procedures (De Rossi & Glick, 1996).
- Neurosurgical shunts (eg in case of hydrocephaly) pose the patient not at increased risk when the shunt is of ventriculo-peritoneal nature, but do require antibiotic prophylaxis when it is a ventriculo-atrial one (Dempsey et al, 1988).

- There is no evidence to support the routine administration of antibiotics for dental procedures in patients with a defibrillator or cardiac pacemaker (Tong & Rothwell, 2000).

Patients with compromised immune system

In the absence of an adequate host immune system, patients are at increased risk for developing bacteraemia progressing to septicaemia. Immunosuppression can be the direct result of a disease process and/or the result of the treatment for the specific condition. However, consensus guidelines are lacking for this type of patients. The use of antibiotic prophylaxis or coverage must be considered on an individual case basis in the following conditions: neutropenia, HIV infection, organ transplantation, long term immunosuppression (e.g. corticosteroid use). Consultation with the treating physician is mandatory in order to evaluate the immune status of the patient, the risks of the planned dental procedure, the choice of antibiotic and the duration of antibiotic coverage.

- Antibiotic coverage is required in patients with reduced neutrophil counts because these individuals are at risk of bacterial infection. When neutrophils are less than one thousand cells per ml, antibiotic coverage is mandatory.
- Children undergoing chemotherapeutic treatment are in need of antibiotic coverage when dental extractions or deep periodontal scaling are necessary (Tong & Rothwell, 2000).
- Children who have deficiency in humoral or T-cell mediated immunity, such as children who receive immunosuppressive medication that they take for prevention of graft rejection or for an autoimmune disease need antibiotic coverage.
- Children infected with the human immunodeficiency virus (HIV) and AIDS need antibiotics if the neutrofil counts are low (Pallasch, 1997).
- Children with diabetes (especially the insulin-dependent type) often exhibit some degree of leukocyte dysfunction. Therefore antibiotic coverage is usually recommended for invasive dental procedures when their condition is poorly controlled or uncontrolled.
- There is still much debate regarding the need for antibiotic coverage in chronic intravenous drug abusers (Glick, 1995) and after splenectomy (Westerman, 1991).

In summary, most odontogenic infections in healthy children resolve by extraction or root canal treatment of an infected tooth. When antibiotics are needed phenoxymethylpenicillin is the first choice. In contrast to healthy children

in medically compromised children the use of antibiotics is often indicated as adjuncts to therapy of orofacial infection, to prevent local infection associated with dental procedures or to prevent the spread of oral micro-organisms to susceptible sites elsewhere in the body. A team work with a paediatrician is important when treating these children.

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