

**DENTAL ASPECTS OF ENDOCARDITIS PROPHYLAXIS : New  
Recommendations from a Working Group of the British Cardiac  
Society Clinical Practice Committee and Royal College of Physicians  
Clinical Effectiveness and Evaluation Unit. 19 April 2004**

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## **Introduction**

It is over 10 years since the endocarditis guidelines of the British Society of Antimicrobial Chemotherapy were published.<sup>(1)</sup> Since that time there have been many advances in the understanding of the susceptibility of patients ‘at risk’ of contracting infective (bacterial) endocarditis.<sup>(2)</sup> In addition, considerable advances have been made as regards the intensity, nature, and causes of bacteraemia of dental origin<sup>(3,4)</sup> Accompanying these developments there have been further advances in the formulation and use of antibiotics.<sup>(5)</sup> It is clear that knowledge and understanding has advanced to the stage where it is appropriate to revise and update the existing guidelines.

It is fortunate that The British Cardiac Society Medical Practice Committee and the Royal College of Physicians Clinical Effectiveness and Evaluation Unit have combined resources to produce comprehensive recommendations on the diagnosis, prophylaxis, and treatment of Infective Endocarditis (IE).<sup>(6)</sup>

This report is an extended excerpt of the main document and covers only the prophylaxis of IE in relation to clinical dental practice. It provides dental practitioners with advice on how to use the recommendations in the context of clinical dental practice with further help provided by a specially developed set of web pages that can be used to help practitioners decide, if, when, and what antibiotic prophylaxis is required.

It is important to note that all the information in this report is derived from the master document of the British Cardiac Society and The Royal College of Physicians.<sup>(6)</sup> This is available on <http://www.bcs.com/library>

## **The Recommendation Development Group**

These recommendations were developed by a working group nominated by the Guidelines and Medical Practice Committee of the British Cardiac Society in collaboration with the Clinical Effectiveness Unit of the Royal College of Physicians (London). Contributors to the recommendation's formulation included representatives of the British Cardiac Society (BCS), the British Junior Cardiologist's Association (BJCA), the Faculty of Dental Surgery of the Royal College of Surgeons of England, the Society of Cardiothoracic Surgeons (SCTS), the British Society of Echocardiography (BSE), the Royal College of Pathologists (Microbiology), the Royal College of Anaesthetists (RCA), the British Association for Nursing in Cardiac Care (BANCC) and the British Cardiac Patients' Association (BCPA). Other bodies with a practical interest in this field such as the Faculty of General Dental Practice of the Royal College of Surgeons of England, The British Dental Association and The American Heart Association were also consulted. Individuals with a special clinical or research interest (informed opinion) were also invited to offer advice.

## **Patients at Risk**

### *Changes in approach*

It is now recognised that the susceptibility to IE varies with the underlying cardiac condition. This is especially so with congenital heart disease where there is differential susceptibility according to the haemodynamic severity of the condition and whether surgery has been palliative or definitive.<sup>(2,7)</sup> This is often related to the turbulence of blood flow with more severe turbulence causing damage to the endothelium which in turn increases the likelihood of a non-bacterial thrombotic vegetation occurring. A bacteraemia from a dental procedure may lead to seeding of the vegetation. Further platelet aggregation covers the bacteria and prevents the body's normal blood borne defenses from killing the bacteria. In this relatively well protected microenvironment the bacteria proliferate and in time, the symptoms and signs of IE appear.

This differential susceptibility is reflected in the document by classifying patients into three risk groups:

<b>Table 1 [Table 3 in the British Cardiac Society/ Royal College of Physicians Recommendations] <sup>(6)</sup></b>
<b>HIGH RISK: CLASS I</b>
Prosthetic heart valves
Previous infective endocarditis
Complex cyanotic congenital heart disease
Transposition of great arteries
Fallot's tetralogy
Gerbode's defect
Surgically constructed systemic pulmonary shunts or conduits
Mitral valve prolapse with clinically significant ] mitral regurgitation or thickened valve leaflets
<b>MODERATE RISK: CLASS II</b>
Acquired valvular heart disease eg: rheumatic heart disease
Aortic stenosis
Aortic regurgitation
Mitral regurgitation
Other structural cardiac defects eg: ventricular septal defect
Bicuspid aortic valve
Primum atrial septal defect
Patent Ductus Arteriosus
Aortic root replacement
Coarctation of aorta
Atrial septal aneurysm/patent foramen ovale
Ventricular septal defect
Hypertrophic obstructive cardiomyopathy
Subaortic membrane
<b>LOW RISK: CLASS III (NOT REQUIRING ANTIBIOTIC PROPHYLAXIS)</b>
Pulmonary stenosis

Surgically-repaired atrial septal defect,
Surgically repaired ventricular septal defect,
Surgically repaired patent ductus arteriosus,
Post Fontan or Mustard procedure without residual defect/murmur
Previous coronary artery bypass surgery
Isolated secundum atrial septal defect ~
Mitral valve prolapse without regurgitation
Innocent heart murmurs <sup>@</sup>
Cardiac pacemakers/defibrillators* <sup>\$</sup>
Coronary artery stent implantation*
Heart / Heart and Lung Transplant**
Pulmonary stenosis
~ Antibiotic prophylaxis is recommended for up to 12 months after ASD/PFO catheter-based closure procedures
* Unless these procedures are being performed in patients at moderate or high risk of endocarditis when antibiotic prophylaxis is advisable. Antibiotic prophylaxis is not required for patients with previous pacemaker, defibrillator or coronary stent implantation.
\$ Pre and post procedure antibiotics are generally used routinely (see Table 10 in original document)
<sup>@</sup> If unsure as to the exact nature of the murmur and the need for prophylaxis, an opinion should be sought from a cardiologist. In an emergency or when it is difficult to obtain specific advice then antibiotic prophylaxis should be given prior to dental or surgical treatment
**Within the first 6 months after heart/heart-lung transplantation, patients should receive antibiotic prophylaxis
] Mitral regurgitation should be obvious clinically or judged by a cardiologist to be more than physiological on Doppler echocardiography

## HOW TO PROCEED: STEP 1

When assessing a patient for dental treatment the medical history will reveal the existence of a cardiac problem. The above table should be consulted to determine the cardiac risk category of the patient. For example, the patient may report that he/she has mitral valve prolapse with mitral regurgitation. It is clear that the patient is in the High Risk group and that antibiotic prophylaxis against IE is required for any bacteraemia inducing procedures.

Patients who are known to be at risk should carry a Warning Card. This should indicate:

1. The precise type of cardiac lesion present.
2. The degree of risk of developing Infective Endocarditis.
3. Whether or not the patient is allergic to Penicillin and the antibiotic prophylaxis that would normally be given to that patient.
4. The name and telephone number of the Cardiologist who can be contacted for advice.

The full British Cardiac Society recommendations for diagnosis and treatment of Infective Endocarditis are given at <http://www.bcs.com/library>

## **Significant Bacteraemia**

### *Changes in Approach*

The term significant bacteraemia has been used loosely and without satisfactory definition for many years. In the new recommendations the term has been interpreted in a specific and unambiguous way.

1. The use of the term ‘...procedures that cause significant bleeding...’ has been abandoned. This is because it has been shown in a detailed study that bleeding following dental treatment procedures is a poor predictor of odontogenic bacteraemia.<sup>(3)</sup> Consequently, the criterion of ‘significant bleeding’ has been discarded as an indication for antibiotic prophylaxis in cardiac patients at risk of developing IE.

2. The term significant bacteraemia has been newly defined as ‘Dental bacteraemia

following a dental procedure that is 'statistically significantly different from the pre-procedure bacteraemia'. That is to say Post Procedure Bacteraemia is statistically significantly greater than the Pre Procedure Bacteraemia. The term procedure covers surgical procedures such as dental extractions and mucoperiosteal flaps but also procedures such as matrix band and wedge placement, placement of gingival retraction cord or rubber dam placement.

Using this definition it has been possible to review the literature (back to the 1930's) on odontogenic bacteraemia and exclude those reports where the investigators did not take a pre-operative blood sample. In this way, *only* studies that reported statistically significant differences have been included for antibiotic prophylaxis of IE. An additional refinement of these data is to list both significant bacteraemia and non-significant bacteraemia side by side in related groups and procedures. (Table 2)

#### **HOW TO PROCEED: STEP 2.**

If the cardiac condition requires that antibiotic prophylaxis is administered to eliminate odontogenic bacteraemia the clinician should look at the following table and determine which dento-gingival procedures are likely to be used when providing care. The details below will assist with this.

#### **TABLE 2. [Table 4 in the British Cardiac Society Document] DENTAL PROCEDURES AND ENDOCARDITIS PROPHYLAXIS FOR HIGH AND MODERATE AT-RISK CASES**

##### **Preliminary Considerations**

Dental treatment is often made up of a series of Dento Gingival Manipulative Procedures. For example, a dental extraction may comprise an Intra Ligamentary Injection, Pre-Extraction Scaling, and Extraction of the tooth with forceps. Thus clinicians should consider the planned dental care, check with the list below, and if one of the procedures requiring prophylaxis is to be used then antibiotic prophylaxis should be administered. There are some difficulties which may be resolved with some thought.

An example of a treatment procedure that may be carried out ‘without’ and ‘with’ antibiotic prophylaxis is endodontic treatment confined to the root canal. When the table is consulted it is clear that antibiotic prophylaxis is not required. If rubber dam is to be used then even if the endodontic procedure is confined to the root canal antibiotic prophylaxis should be used because of the significant bacteraemia caused by the placement of the rubber dam.

<b>RECOMMENDED FOR ANTIBIOTIC PROPHYLAXIS</b>	<b>NOT RECOMMENDED FOR ANTIBIOTIC PROPHYLAXIS</b>
<b><i>Examination Procedures</i></b>	<b><i>Examination Procedures</i></b>
Periodontal probing <sup>(8)</sup>	Dental examination with mirror & probe <sup>(9)</sup>
<b><i>Investigation Procedures</i></b>	<b><i>Investigation Procedures</i></b>
Sialography <sup>(10)</sup>	Intra oral radiographs
	Extra oral radiographs
<b><i>Preventive Procedures</i></b>	<b><i>Preventive Procedures</i></b>
<i>Nil</i>	Fissure Sealants
	Fluoride treatments
<b><i>Professional Cleaning Procedures</i></b>	<b><i>Professional Cleaning Procedures</i></b>
Polishing teeth with a Rubber Cup <sup>(11)</sup>	Air polishing <sup>(12)</sup>
Oral irrigation with water jet <sup>(13,14)</sup>	
Light scaling <sup>(15)</sup>	
Deep scaling <sup>(15)</sup>	
Scaling teeth with hand instrument <sup>(11,16)</sup>	
Scaling with ultrasonic instrument <sup>(16)</sup>	

<b><i>Anaesthetic Procedures</i></b>	<b><i>Anaesthetic Procedures</i></b>
Intraligamental local anaesthesia <sup>(17)</sup>	Infiltration local anaesthesia <sup>(17)</sup>
	Nerve block local anaesthesia
	Oral airway for GA <sup>(18)</sup>
	Nasal airway for GA <sup>(18,20)</sup>
	Laryngeal mask airway for GA <sup>(21,22)</sup>
<b><i>Comprehensive Dental Treatment under General Anaesthesia</i></b>	<b><i>Comprehensive Dental Treatment under General Anaesthesia</i></b>
Extractions and Filling <sup>(23,24)</sup>	
<b><i>Conservation (Restorative) Procedures [δ]</i></b>	<b><i>Conservative (Restorative) Procedures</i></b>
Rubber dam placement <sup>(25,26)</sup>	Slow & Fast drilling of teeth (without rubber dam) <sup>(25,26)</sup>
Matrix band and wedge placement <sup>(24,25)</sup>	
Gingival retraction cord placement <sup>(26)</sup>	
<b><i>Periodontal Procedures</i></b>	<b><i>Periodontal Procedures</i></b>
Root planning <sup>(15)</sup> [similar to scaling]	
Antibiotic fibres or strips placed subgingivally [α]	
Gingivectomy <sup>(15)</sup>	
Periodontal Surgery <sup>(27)</sup>	
<b><i>Endodontic Procedures</i></b>	<b><i>Endodontic Procedures</i></b>
Root canal instrumentation beyond the root apex <sup>(15,28)</sup>	Root canal instrumentation within canal <sup>(15,28)</sup>
	Pulpotomy of primary molar <sup>(29,30)</sup>
	Pulpotomy of permanent tooth [β]
Avulsed tooth reimplantation [γ]	

<b><i>Orthodontic Procedures</i></b>	<b><i>Orthodontic Procedures</i></b>
Tooth separation <sup>(31)</sup>	Alginate impressions <sup>(31)</sup>
Expose OR Expose and Bond of Tooth or Teeth <sup>(32,33)</sup>	Band placement and cementation <sup>(31,34,35)</sup>
	Band removal <sup>(36,37)</sup>
	Adjustment of fixed appliances <sup>(31)</sup>
<b><i>Surgical Procedures</i></b>	<b><i>Surgical Procedures</i></b>
Extraction of a single tooth <sup>(9,15,38,39)</sup>	Incision and drainage of an abscess <sup>(40)</sup>
Extraction of multiple teeth <sup>(9,15,32,39)</sup>	Biopsy
Mucoperiosteal flap to gain access to tooth or lesion. <sup>(32,33)</sup>	
Dental Implants (as for Mucoperiosteal flap)	Dental Implants Transmucosal fixture (as for biopsy)
<b><i>Post Surgical Procedures</i></b>	<b><i>Post Surgical Procedures</i></b>
None – as at July 2002	Suture removal <sup>(41,42,43)</sup>
	Removal of Surgical Packs (as for suture removal)
<b><i>Other Events (Daily or Physiological Events)</i></b>	<b><i>Other Events</i></b>
Antibiotic prophylaxis not recommended as it is impractical despite presence of bacteraemia following some of these events. This is largely because of the significant risk of development of bacteria resistant to the antibiotics used	Toothbrushing
	Exfoliation of primary teeth
[α] no data but the procedure is very similar to that of gingival retraction cord placement	
[β] no data but the procedure is similar to pulpotomy of a primary molar	
[γ] the avulsed tooth can be quickly washed and re-implanted immediately by a parent or other responsible person and the antibiotic prophylaxis administered when the child attends the dental surgery provided this is within 2 hour of the reimplantation. This is because antibiotic prophylaxis is still successful if administered after the bacteraemic episode. <sup>(44)</sup>	
[δ] it is common for a course of dental treatment to take place over several visits to the dentist. For patients at high or moderate risk of developing infective endocarditis as	

much treatment as possible should be carried out at each visit. The antibiotic should be changed at alternate visits e.g. Amoxicillin – Clindamycin – Amoxicillin and so on. For young children the sequence would be Amoxicillin – Azithromycin – Amoxicillin and so on. If penicillin or penicillin related antibiotics are used as one of the antibiotics then a period of 1 month must be allowed between visits when a penicillin antibiotic is used. <sup>(45,46)</sup> Dentists can help further by planning dental care to minimize the number of times that patients are exposed to antibiotics by carrying out as much treatment as is feasible at each visit.

In an emergency when treatment needs to be carried out urgently the dental surgeon should make an assessment as to whether or not the patient is significantly at risk from IE. If the answer is affirmative, the patient's clinical records should then be marked appropriately and consideration given to the risk of bacteraemia associated with the dental procedures to be carried out on the patient. If there is a risk of a significant bacteraemia then antibiotic prophylaxis should be given.

### **HOW TO PROCEED: STEP 3**

If it has been decided that antibiotic prophylaxis is required then the choice of antibiotic, the dosage and the mode of administration should be made after scrutinising Tables 3 and 4.

#### **Current Antibiotic Advice**

##### *Developments in Antibiotics*

The wider use of newer antibiotics and changes in formulation of other antibiotics has led to a re-appraisal of antibiotics suitable for prophylaxis in children and adults. These are presented as regimens suitable for use with Local Anaesthesia (LA) or no anaesthesia. (Table 3 [Table 6 in the BCS recommendations]) Where the treatment is to be carried out under General Anaesthesia (GA) or Intravenous Sedation (IVS) then alternative drug regimens are recommended. (Table 4 [Table 6 in the BCS recommendations]).

Table 3

**DENTAL TREATMENT UNDER LOCAL ANAESTHESIA (OR PROCEDURES WITHOUT LOCAL ANAESTHESIA)**

**Class I. High Risk of Developing Infective Endocarditis  
and  
Class II Moderate Risk of Developing Infective Endocarditis**

<i>Clinical Situation</i>	<i>Drug</i>	<i>Regimen</i>
Patients <i>not</i> allergic to Penicillin or Patients who have <i>not</i> received more than a single dose or course of penicillin in the previous month	<b>Amoxicillin</b>	<p><b>Adults</b> Oral Amoxicillin 3g administered 1 hour before the procedure</p> <p><b>Children</b> &lt; 5 years: Oral Amoxicillin 750mg administered 1 hour before the procedure</p> <p>5-10 years: Oral Amoxicillin 1.5g administered 1 hour before the procedure</p> <p>&gt; 10 years use adult dose</p>
Patients <i>allergic</i> to Penicillin or who have had more than a single dose or course of Penicillin (or other Beta Lactam antibiotic) within the last month	<b>Clindamycin</b>	<p><b>Adults-</b> Oral Clindamycin 600mg 1 hour before the procedure</p> <p><b>Children</b> &lt; 5 years Oral Clindamycin 150 mg administered 1 hour before the procedure</p> <p>5-10 years Oral Clindamycin 300 mg administered 1 hour before the procedure</p> <p>&gt; 10 years use adult dose</p>
<i>[The oral suspension of Clindamycin is no longer available in the United Kingdom. If children are unwilling or unable to swallow tablets or</i>	<b>Azithromycin</b> (as a suspension)	<p><b>Adults</b> 500 mg administered 1 hour before the procedure</p> <p><b>Children</b></p>

*capsules, or patients are suffering with dysphagia, then Azithromycin is a suitable alternative.]*

< 5 years Oral Azithromycin 200mg administered 1 hour before the procedure

5-10 years Oral Azithromycin 300mg administered 1 hour before the procedure

> 10 years use adult dose of 500mg 1 hour before the procedure

## Special Considerations:

### Multiple Visits for Treatment Using Local (or no) Anaesthesia

For a care plan that will require several visits then a period of 1 month should elapse before the second dose of the same antibiotic. If treatment is planned to extend over more than two visits then Amoxicillin should be used one visit and Clindamycin (or Clarithromycin) for the next visit. This alternating sequence can be continued until treatment is complete and the time interval between different types of antibiotics does not need to exceed one month.

### For Those at Highest Risk of IE eg: Patients with Prosthetic Heart Valves or Previous IE

**Adults** - Intravenous **Amoxicillin** 2G 30 minutes before the procedure  
*plus* Intravenous **Gentamicin** 1.5mg/kg within the same time period

*Followed post-operatively by* Intravenous **Amoxicillin** 1G  
or Oral **Amoxicillin** 1G 6 hours post procedure

**Children** < 5 years as for < 10years

< 10 years Intravenous **Amoxicillin** 1G 30 minutes before the procedure  
*plus* Intravenous **Gentamicin** 1.5 mg/kg within the same time period

*Followed postoperatively by* Oral **Amoxicillin** at 6 hours post procedure

### For Patients Allergic to Penicillin

**Adults** - Intravenous **Vancomycin** 1G infused over the 2 hours before the procedure  
*plus* Intravenous **Gentamicin** 1.5mg/kg within the same time period

**Children** < 5 years as for < 10years

< 10 years Intravenous **Vancomycin** 20mg/kg over the 2 hours before the procedure  
*plus* Intravenous **Gentamicin** 1.5 mg/kg within the same time period

> 10 years, use the adult dose

^^ Not in the current recommendations but recently it has been shown to be as effective as IV Ampicillin<sup>(47)</sup> as been used for several years as part of an antibiotic policy at Great Ormond Street Hospital. This regimen should be reserved for use in hospitals or areas where there is a special antibiotic policy to help cope with MRSA

**Adults & Children** Intravenous **Teicoplanin** 6mg/kg *plus* Intravenous **Amikacin** 15mg/kg immediately before the procedure

### **Class III. Low Risk of Developing Infective Endocarditis**

No Antimicrobial Prophylaxis Required

The need for a General Anaesthesia (GA) or Intra Venous Sedation (IVS) requires a modification to the drug regimen particularly with regard to dosage. (Table 4 [Table 6 in the BCS recommendations]).

Table 4.

**DENTAL TREATMENT UNDER GENERAL ANAESTHESIA,  
INTRAVENOUS SEDATION, OR PATIENTS UNABLE TO TAKE  
ORAL MEDICATIONS**

<i>Clinical Situation</i>	<i>Drug</i>	<i>Regimen</i>
Patients <i>not</i> allergic to Penicillin or Patients who have <i>not</i> received more than a single dose or course of penicillin in the previous month.	<b>Amoxicillin or Ampicillin</b>	<p><b>Adults</b> IV Amoxicillin 2g administered upon attainment of GA and immediately before the dental procedure</p>
		<p><b>Children</b> &lt; 5 years IV Amoxicillin 500mg administered upon attainment of GA and immediately before the procedure</p> <p>5-10 years IV Amoxicillin 1g administered upon attainment of GA and immediately before the procedure</p> <p>&gt; 10 years use adult dose 2g administered immediately before the procedure</p>
Patients allergic to Penicillin or who have had more than a single dose or course of Penicillin (or other Beta Lactam antibiotic) within the last month	<b>Clindamycin</b>	<p><b>Adults</b> IV Clindamycin 300 mg infused over at least 10 minutes upon attainment of GA and commenced before the start of the dental surgery. This is followed by oral or IV Clindamycin 150 mg 6 hours later</p>
		<p><b>Children</b> &lt; 5 years IV Clindamycin 75 mg infused over at least 10 minutes upon attainment of GA and commenced before the start of the dental procedure</p> <p>5-10 years IV Clindamycin 150mg infused over at least 10 minutes upon attainment of GA and commenced</p>

before the start of the dental procedure

> 10 years use adult dose

**Special concern :**

for those at highest risk of IE eg: Prosthetic Heart Valve or Previous Infective Endocarditis see Table 3.

**Summary of the New Approach:**

Consult the BCS recommendations (paper document) or the abstracted dental recommendations in the current web pages (<http://www.bcs.com>) or <http://www.fds.rcseng.ac.uk>

**1. Assessment of Cardiac Risk** - Determine the cardiac risk from Table 1. If the risk is Moderate or High then the patient requires antibiotic prophylaxis for procedures that produce a significant bacteraemia. If the risk is deemed to be Low then no antibiotic is required for prophylaxis against Infective Endocarditis.

**2. Assessment of Risk of Significant Bacteraemia** - If the cardiac risk is Moderate Risk or High Risk then the dentist should consider the details of the dental procedure. If any planned dento-gingival manipulative procedure causes a significant bacteraemia then it is clear that antibiotic prophylaxis is needed. The dental surgeon must undertake a careful appraisal of all dento gingival manipulative procedures listed in Table 2 at the planning stage of the operation to ensure that all bacteraemia inducing procedures are included in the appraisal. If the dental bacteraemia risk is 'non-significant' then antibiotic prophylaxis is not required even if the patient is moderate or high risk as regards the cardiac lesion.

**3. Assessment of Antibiotic Prophylaxis** - The choice of antibiotic regimen needs to be made by first identifying whether treatment is to be carried out under no or local anaesthesia. Table 3 provides the information required. If treatment is to be carried out under general anaesthesia or intravenous sedation then the required information is in Table 4. For special concern patients, that is those with a prosthetic valve and/or previous endocarditis, it is important to remember to use IV Amoxicillin and Gentamicin or IV Vancomycin and IV Gentamicin. An alternative is Amikacin and Teicoplanin.

The information can be obtained from web pages on the Royal College of Surgeons of England, ( [www.rcseng.ac.uk](http://www.rcseng.ac.uk) ) or The Eastman Dental Institute and Hospital website. ( [www.eastman.ucl.ac.uk](http://www.eastman.ucl.ac.uk) )

Finally, it is important to write down the reasons for giving the antibiotic prophylaxis and the choice of antibiotics. For a patient 'at risk' of developing endocarditis it is important that he/she understands the need to consult the doctor if any symptoms develop which may possibly be related to the onset of infective endocarditis. For example, an unexplained fever or general malaise.

Adherence to the recommendations whenever possible is recommended but it is recognised that there may be occasional circumstances where the clinician is required to adapt the recommendations to fit a particular clinical scenario. The reasons for the choices made must be recorded in the patient's notes.

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