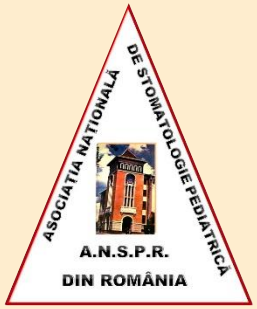
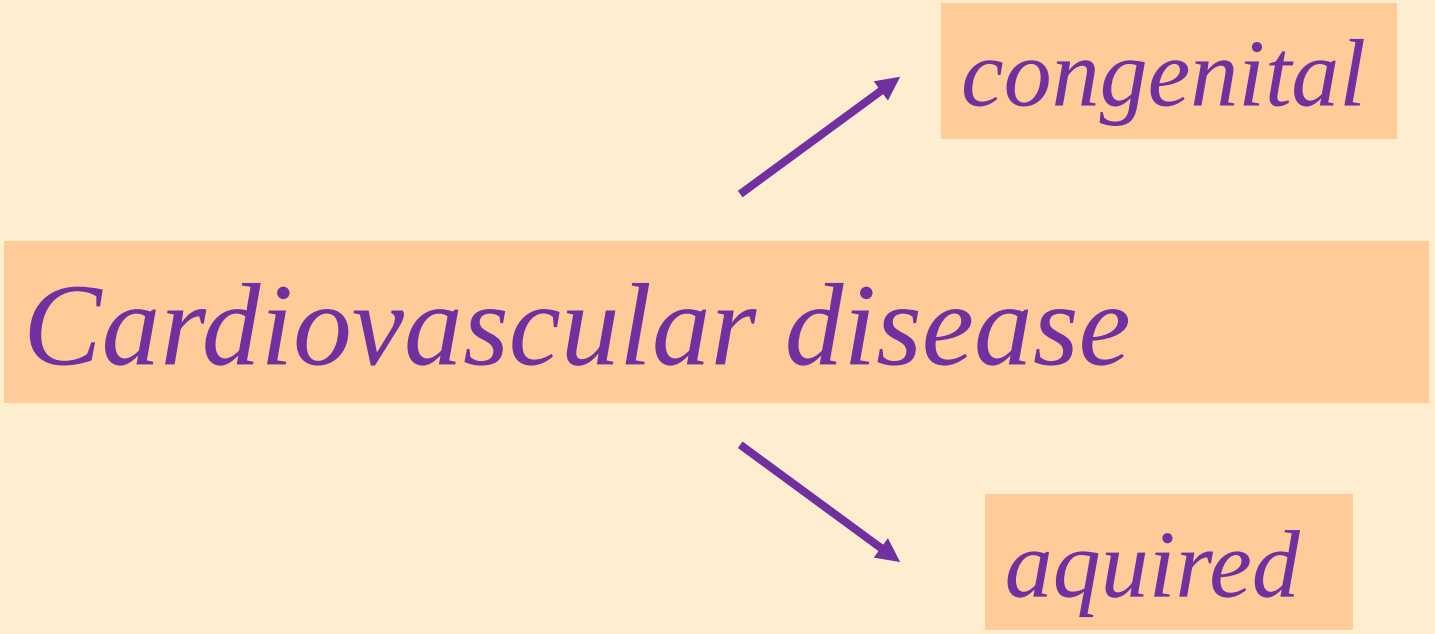
the Child Dental Patient with

associated

Cardiovascular Disease




congenital
Cardiovascular disease
aquired

Congenital heart defects (CHD)

- defect in structure and/or function of the heart and great vessels which is present at birth; the most common congenital problem in newborns (0.8% live births)

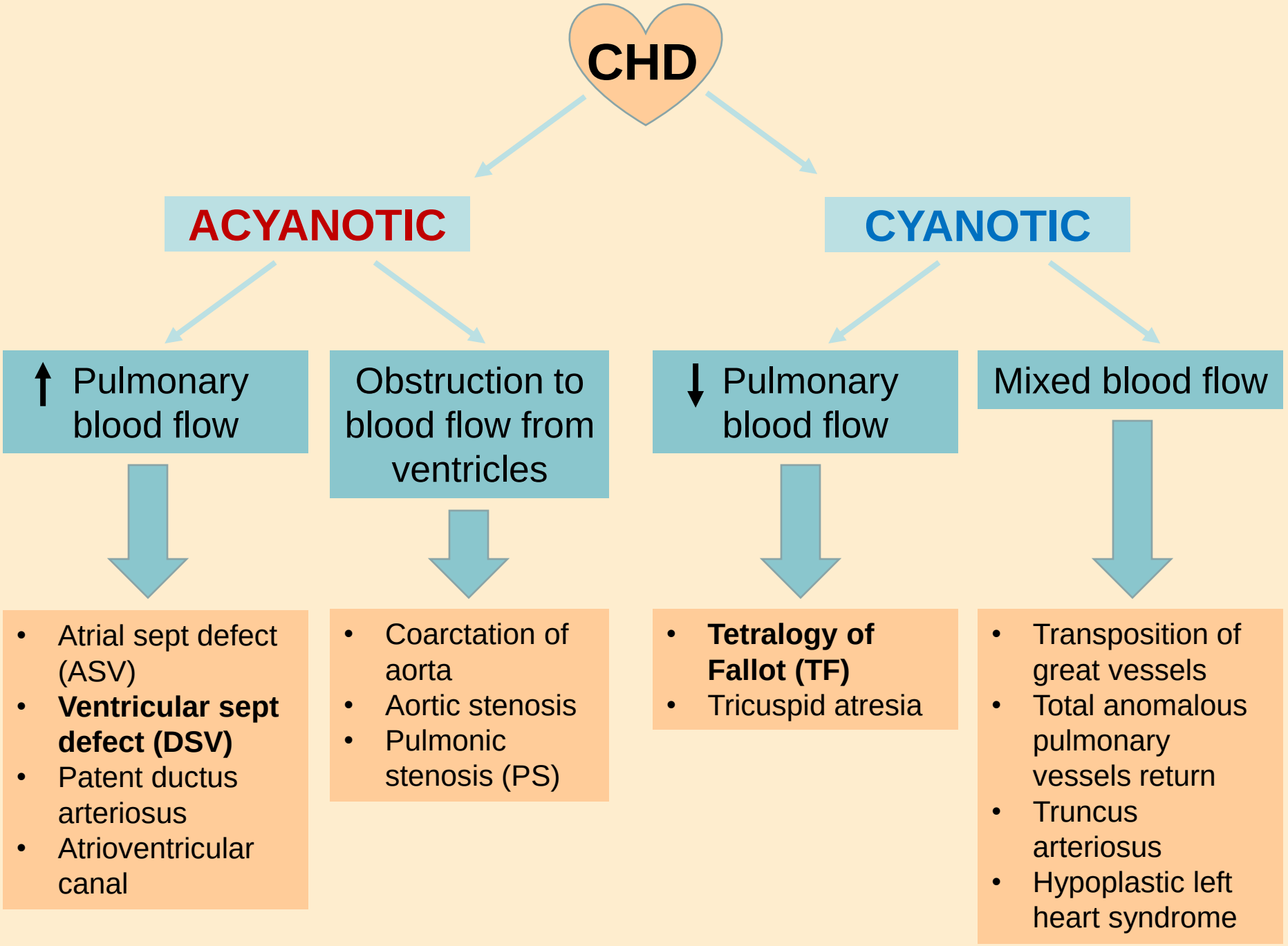
- etiology: multifactorial (genetic + environmental)

- can be associated with syndromes (Down, Turner)

♡ 40 - 60% of children born with *Down Syndrome* have a CHD; most common CHDs in Down Syndrome are Atrioventricular Septal Defect, Ventricular Septal Defect, Persistent Ductus Arteriosus,Tetralogy of Fallot.

♡ Common CHDs in *Turner Syndrome*: Bicuspid aortic valve, coarctation of aorta, aortic arch anomalies

- increased risk → of developing oral disease
→ from the systemic effects of oral disease (Infective Endocarditis)


CHD
ACYANOTIC
CYANOTIC
↑ Pulmonary blood flow
Obstruction to blood flow from ventricles
↓ Pulmonary blood flow
Mixed blood flow
• Atrial sept defect (ASV)
• **Ventricular sept defect (DSV)**
• Patent ductus arteriosus
• Atrioventricular canal
• Coarctation of aorta
• Aortic stenosis
• Pulmonic stenosis (PS)
• **Tetralogy of Fallot (TF)**
• Tricuspid atresia
• Transposition of great vessels
• Total anomalous pulmonary vessels return
• Truncus arteriosus
• Hypoplastic left heart syndrome

CHD

Most common:

Ventricle Septal Defect (VSD) - 25-28%

- wide range of pathological conditions, such as Pulmonary Atresia with Ventricle Septal Defect (PA/VSD).
- systemic circulation of oxygen-poor blood (cyanosis), with associated *features and consequences in the oral cavity*

Tetralogy of Fallot (TF) – ~10% of all CHD, prevalence >2/10.000 births, m>f)

- 4 cardiac abnormalities:
  - maligned ventricular septal defect (VSD)
  - sub-pulmonary stenosis
  - overriding aorta
  - right ventricular hypertrophy

CHD & oral health

CHD impact upon oral health with respect to:

A. Dentition – a) systemic influences:

- ameloblasts can be extremely sensitive to metabolic alterations during tooth formation (VSD, PS) → thinner and/or softer enamel tissue → teeth more susceptible to faster destruction due to caries and more difficult to restore.
- higher risk of ECC
- delayed tooth eruption
- stomatitis, glossitis, cyanotic mucus membrane

b) Local cariogenic influences – medication with high sugar content (up to 30% sucrose) → high caries risk

→ Need for early oral examination → promotion of personalized hygiene measures and the implementation of therapeutic procedures in children affected by PS/VSD → DENTAL HOME

(Garrocho-Rangel et al, 2017)

CHD & oral health

CHD impact upon oral health with respect to:

B. Risk of systemic hazardous implications of dental origin

- **Infective Endocarditis** (IE)
- Brain abscess of dental origin (Moskowitz et al, 2012)

C. Implications of cardiac medication (anticoagulants) upon dental treatment

- risk of bleeding

Oral features in children with CHD

- Higher prevalence of
  - Dental caries
  - Periodontal disease – gingivitis, plaque, calculus, recesses

- Risk factors:

  - Reduced salivary secretion because of medication
  - Chronic administration of liquid sucrose-sweetened oral drugs
  - Presence of developmental enamel defects

Preventive strategies

- First dental visit – before the age of 1y → dental home

  → Efficient primary prevention
- Routine dental examinations
- Daily plaque removal by toothbrushing and flossing; use high fluoride content toothpaste (1000-1500 ppm)
- Children toothbrushing performed by parents BEFORE the intake of high-sucrose-content pediatric medications (→ protective “shield”); rigorously rinse afterwards / drink more water
- Fluoride varnish applications
- Caries control by topical application of Chlorhexidine - gel 2% or solution 0.12% with cotton tips
- Dietary counseling – cease bottle feeding a.s.a.p., limit sugar intake before meals
- Pit and fissure sealants immediately after eruption; glass-ionomer sealants before complete eruption; close monitoring

Some countries have dedicated oral health strategies for children with CHD – e.g. UK:

Classification: Official
Level 1 – Specialist Children's Surgical Centres. Section M - Dental

Standard	Paediatric	Implementation timescale
M1(L1)	Children and young people and their parents/carers will be given appropriate evidence-based preventive dental advice at time of congenital heart disease diagnosis by the cardiologist or nurse.	Immediate
M2(L1)	All children and young people with planned elective cardiac surgery or intervention must have a dental assessment as part of pre-procedure planning to ensure that they are dentally fit for their planned intervention.	Immediate
M3(L1)	All children at increased risk of endocarditis must be referred for specialist dental assessment at two years of age, and have a tailored programme for specialist follow-up.	Immediate
M4(L1)	Each Congenital Heart Network must have a clear referral pathway for urgent dental assessments for congenital heart disease patients presenting with infective endocarditis, dental pain, acute dental infection or dental trauma. All children and young people admitted and diagnosed with infective endocarditis must have a dental assessment within 72 hours.	Immediate
M5(L1)	Specialist Children's Surgical Centres must provide access to theatre facilities and appropriate anaesthetic support for the provision of specialist-led dental treatment under general anaesthetic for children and young people with congenital heart disease.	Immediate
M6(L1)	Specialist Children's Surgical Centres will refer children with CHD to a hospital dental service when local dental services will not provide care.	Immediate

Source: https://www.england.nhs.uk/wp-content/uploads/2018/08/Congenital-heart-disease-standards-and-specifications.pdf

Dental treatment for children with CHD

- Always take thorough medical history; updates must be done at every appointment.
- Only ASA I and II patients can get dental treatment in ambulatory setting; ASA III patients need hospital setting
- Anxiety and pain can enhance sympathetic activity → endogenous adrenaline release → increase risk of arrythmias / angina
- Short, stress-free appointments; inhalation sedation can be considered; use anxiety reduction protocol
- Efficient pain-control – local anaesthesia (maximum 2 carpules/ 4ml, with 1:80.000 / 1:100.000 epinephrine content)
- Endogenous epinephrine peaks during morning hours → late morning appointments are recommended

Dental treatment for children with CHD

Use of dental anaesthetics +

Adrenaline, felypressin ✓

Noradrenaline ?

Midazolam* ✓

Serrera Figallo M et al: Use of anesthetics associated to vasoconstrictors for dentistry in patients with cardiopathies. Review of the literature published in the last decade. J Clin Exp Dent. 2012 Apr; 4(2): e107–e111

*Middlehurst RJ et al: Cardiovascular risk: the safety of local anesthesia, vasoconstrictors, and sedation in heart disease. Anesth Prog. 1999 Fall; 46(4): 118–123

Dental treatment for children with CHD

ATTENTION ! Avoid the use of:

- Electrosurgery
- Electronic pulp testers
- Ultrasonic cleaning devices

} In children with cardiac pacemakers

- Conscious sedation and nitrous oxide-oxygen analgesia reduce anxiety in such patients

Monitored vital signs and oxygen saturation during the procedure

!!! Cardiopulmonary resuscitation equipment should be available

Dental treatment for children with CHD

- In children with CHD requiring cardiac surgery, dental treatment needs to be performed **before** surgery in order to eliminate potential or active oral infective sites

- There is an increased risk of IE from residual infection in primary tooth canals, which are difficult to debride thoroughly (Hallet *et al*., 1992) ➔ extraction/space maintainer vs. a pulpectomy procedure in primary teeth are preffered;

- Endodontic procedures are recommended only in permanent teeth with straight canals and closed apex (Babaji, 2009)

- Patient's oral cavity should be rinsed with 0.2% chlorhexidine gluconate before any dental procedure.

Infective endocarditis (IE)

Infective endocarditis (IE)

- Life-threatening complication resulting from bacteremia
- The annual incidence of infective endocarditis in children (under 18 years old) is around 90/100,000 children.
- High mortality rate (5-10%) in children

IE risk

- ~ 1/8 of children with CHD may develop IE if exposed to oral bacteremia after a dental procedure (FitzGerald et al., 2010; Puspa-Pertiwi et al., 2007; Balmer and Bu'lock, 2003)

- Bacterial species from oral cavity more frequent involved:
  - *Viridans streptococci*
  - *Staphylococcus aureus*
  - *Enterococcus*

Endocarditis- Clinical symptoms

- Low, irregular fever (afternoon or evening peaks)
- Sweating
- Malaise
- Anorexia
- Weight loss
- Arthralgia
- Anemia
- Painful finger and toes
- Heart murmur
- Fatigue
- Aching joints and muscles
- Shortness of breath
- Pallor
- Persistent cough
- Unexplained weight loss
- Tenderness of the spleen

Dental procedures considered for antibiotic prophylasis at risk of IE

➔ All dental procedures that involve manipulation of gingival tissue or the periapical region of the teeth or perforation of the oral mucosa:

- 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

- Wilson et al. Prevention of Infective Endocarditis. Circulation 2007;116(15): 1736-54
- American Medical Association, Dajani et al., 1997

Procedures for which antibiotic prophylaxis is NOT needed

- Local anaesthetic injections in non-infected tissues
- Treatment of superficial caries
- Removal of sutures
- Dental X-rays
- Placement of adjustment of removable prosthodontic or othodontic appliances or braces
- Following the shedding of primary teeth
- Trauma to the lips or oral mucosa

Wilson et al. Prevention of Infective Endocarditis. Circulation 2007;116(15): 1736-54

ADA and AHA current guidelines for IE prophylaxis:

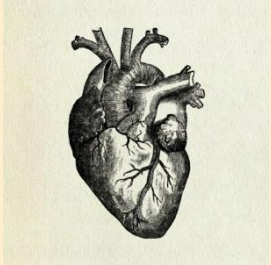
The risk of adverse reactions to antibiotics generally outweigh the benefits of prophylaxis for many patients who would have been considered eligible for prophylaxis in previous versions of the guidelines.

The development of drug-resistant bacteria is a concern.

IE prophylaxis for dental procedures should be recommended only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE.

Source: https://www.ada.org/en/member-center/oral-health-topics/antibiotic-prophylaxis

AB before dental procedures - recommended in :



- prosthetic heart valve / heart valve repaired with prosthetic material
- history of IE
- heart transplant with abnormal heart valve function
- **some** congenital heart defects (CHD)

CHD needing AB prevention of IE before selected dental procedures :

- cyanotic congenital heart disease NOT fully repaired, including children who have had a surgical shunts and conduits.
- completely repaired with prosthetic material / device for the first six months after surgery.
- repaired with residual defects (persisting leaks / abnormal flow at or adjacent to a prosthetic patch or prosthetic device.
- **All** patients with a mechanical or tissue artificial valve

AHA 2007, revised 2018

AB before dental procedures at risk:

(ADA, 2017) Single Dose, 30 to 60 min. before dental procedure

Amoxicillin	50 mg/kg	Oral
Ampicillin / Cefazolin / Ceftriaxone	50 mg/kg	IM / IV
Cephalexin OR Clindamycin OR Azithromycin or clarithromycin	50 mg/kg 20 mg/kg 15 mg/kg	Oral
Cefazolin or ceftriaxone Clindamycin	50 mg/kg 20 mg/kg	IM / IV

! IMPORTANT: allergies to AB must be checked with primary caregiver prior to prescription

IMPORTANT :

♡ If the dosage of antibiotic is inadvertently not administered before the procedure, the **dosage may be administered up to 2 hours after** the procedure.

♡ A **single loading AB** dose covers the period of potential bacteremia produced by a **single procedure**. If another dental procedure also warranting premedication (e.g. dental prophylaxis) is scheduled for the following day, the AB **prophylaxis regimen should be repeated** prior to the second appointment.

♡ If a patient who requires prophylaxis is **already taking AB** for another condition, the dentist must **select an antibiotic from a different class** than the one the patient is already taking (e.g.if the patient is taking amoxicillin, the dentist should select clindamycin, azithromycin or clarithromycin for prophylaxis of IE).

!! Dentists should periodically visit the ADA website for updates on IE prophylaxis.

Source: https://www.ada.org/en/member-center/oral-health-topics/antibiotic-prophylaxis

Implications of anticoagulant medication upon dental treatment

Children with cardiac disease can be on **anticoagulant medication**
e.g. Sintrom, Pradaxa, Clexane, Heparin

➔ can alter **bleeding and clotting time** ➔ impact on potentially bleeding dental procedures

Must be assessed prior to dental treatment

INR (International Normalized Ratio)
- determins the effect of anticoagulants on clotting
– normal values ≤ 1.1

Implications of anticoagulant medication upon dental treatment

Anticoagulant medication dosage may need alterations before dental treatment is carried out.

INR values	Attitude towards anticoagulant dosage
2-3	Do not alter
2.5-3.5	Dosage may need alteration → back to normal after 48-72h
>3.5	Delay invasive procedures

Important: ALL decisions regarding the dosage of medication must be taken / validated by the physician in charge → efficient communication between the dental and medical teams is needed

Important for patients with cardiovascular conditions

IE is much more likely to result from bacteremia associated with daily activities (toothbrushing, flossing, chewing) than from bacteremia caused by a dental procedure!!

The presence of dental disease may increase the risk of bacteremia associated to these daily activities !!

Maintenance of optimal oral health and hygiene may reduce the incidence of bacteremia from daily activities.

Children should avoid traumatic brushing, yet brush efficiently. Plaque gingivitis may cause prolonged bleeding in patients on anticoagulant medication.

Monitoring oral health by regular dental check-ups helps avoid unwanted complications.

Wilson et al. Prevention of Infective Endocarditis. Circulation 2007;116(15): 1736-54