MFDS · DENTAL PHARMACOLOGY · LECTURE 4

Therapeutics: antimicrobials, antifungals, antivirals and analgesics

Dr Mohamed J. Abuasi, Connect Academy · 29/11/2024 · 72 slides, with SDCEP Drug Prescribing For Dentistry (June 2021 update)

EXAM-DAY SUMMARY

everything on this page → detail in §§ overleaf

FOUR TARGETS → §1

- Cidal = cell wall + nucleic acid; static = protein + metabolic
- Wall: penicillin · cephalosporin · vancomycin. Nucleic acid: metronidazole · rifamycin · quinolone
- Protein: gentamicin · tetracycline · clindamycin · macrolide · chloramphenicol. Folate: sulphonamide · trimethoprim

PENICILLINS → §2

- Bind PBP (transpeptidase) → no cross-link → lysis
- Pen G: narrow, G+, inactive orally, acid-labile, not DPF, highly protein-bound. Pen V: oral equivalent, same spectrum, acid-stable, less bound
- Ampicillin: 1st broad-spectrum, crosses G− outer membrane, poor orally. Amoxicillin: same spectrum, oral/injection, most used
- Allergy — rash (amoxicillin rash in mononucleosis); 10% cross-allergy with cephalosporins (deck figure; truly ~1–2%); never prescribe after anaphylaxis, urticaria or immediate rash

B-LACTAMASE AND MRSA → §3

- β-lactamase (ESBL) → penicillin becomes penicilloic acid
- Co-amoxiclav 500+125 = 625; 875+125 = 1000; child 375 — never IM (necrosis). Unacin 500+250 = 750; 1000+500 = 1500; 250+125 = 325
- Penicillinase-resistant: methicillin, nafcillin, oxacillin, di/cloxacillin, flucloxacillin; Flumox = amox + flucloxacillin
- MRSA: resistant to all β-lactams; vancomycin → resistance = VRSA; across classes = MDR

CEPHALOSPORINS · VANCOMYCIN → §4

- 4 generations; more G− than G+ and β-lactamase resistant — except 1st generation (both rules)
- 1st cephradine · 2nd cefoxitin · 3rd cefotaxime · 4th cefozopran. Effects: 10% cross-allergy · renal failure · diarrhoea
- Vancomycin: binds NAM/NAG; G+ only; last resort; ototoxic, nephrotoxic, phlebitis; teicoplanin safer/dearer; oral vancomycin = 1st choice in *C. difficile* colitis

METRONIDAZOLE · SULPHONAMIDES → §5

- Anaerobes; antamoebic, antiprotozoal; + amoxicillin in aggressive periodontitis and ANUG
- Alcohol → disulfiram reaction; potentiates warfarin; metallic taste → avoid breast feeding 6 months
- Sulphonamides: folate block; C/I pregnancy + folate deficiency; haemolytic anaemia; erythema multiforme / SJS

PROTEIN-SYNTHESIS DRUGS → §6

- Gentamicin: topical; oto- + nephrotoxic. Chloramphenicol: eye drops, typhoid; aplastic anaemia, grey baby
- Tetracycline: chelates Ca/Fe/Al/Mg → before food; C/I <12 y and pregnancy; RAU, pockets, triple paste
- Clindamycin: diffuses hard + soft tissue; osteomyelitis, parotid abscess, IE prophylaxis; 300 mg tds 5 d (child 100); colitis; slow IV only
- Macrolides: penicillin-like spectrum but static — the penicillin-allergy alternative

PRESCRIBING IN GDP → §7

- Drainage first — antibiotics are the adjunct; only if systemic signs or drainage impossible. Ladder: pen V → metronidazole → macrolide (+ fluids, rest, review)
- Systemic: diffuse swelling · eye closure · trismus · dysphagia · pyrexia · airway obstruction · failure to respond
- Pericoronitis: 1st episode irrigation + operculectomy; 2nd episode extraction; metronidazole if systemic

DOSES TO KNOW → §7

- Pen V 500 mg qds × 5 days, 30 min before food (SDCEP first line)
- Metronidazole abscess 400 mg tds × 5 d (15 tabs); NUG/pericoronitis and ANUG 400 mg tds × 3 d (9 tabs)
- Aggressive perio: amoxicillin 250 mg tds + metronidazole 200 mg tds, 7–10 d. Sinusitis: pen V 250 mg × 2 qds × 5 d (40 tabs), doxycycline if allergic

PROPHYLAXIS · IE → §8

- Healthy: only oro-antral communication. Compromised: immunosuppression · uncontrolled DM · high-risk IE
- High-risk patient: prosthetic valve · previous IE (pacemaker = LOW). Procedure: any bleeding — extraction, surgery, implant, scaling
- NICE CG64: not recommended *routinely*; non-routine only with cardiologist

ANTIFUNGAL · ANTIVIRAL · ANALGESICS → §9 · §10 · §11

- Treat the cause of low resistance first; nystatin topical 1 ml qds till 2 d after healing — safest, first in children
- Miconazole = best for angular cheilitis (strep + staph + candida); azoles C/I with warfarin, statins, pregnancy. Fluconazole 50 mg od 7–14 d, 2nd line
- Aciclovir (prodrome only): simplex 200 mg 5×/5 d, zoster 400 mg 5×/7 d; double if immunocompromised
- Aspirin: ulceration, gut irritation, blood thinner, Reye (deck <12; BNF <16). Ibuprofen: same but less gut irritant, no thinning
- Paracetamol: no anti-inflammatory, no gastric irritation, no bleeding effect. Also revised: zoster aciclovir 800 mg 5×/7 d; miconazole gel 2.5 ml qds

§1 The prescribing framework and how antimicrobials are classified

Dental prescribing in the United Kingdom rests on two reference works and two pieces of guidance. The **British National Formulary (BNF)** and the **BNF for Children (BNFC)** carry the licensed doses, interactions and cautions; the deck illustrates BNF 79 (March–September 2020), but the edition matters — doses change between editions, and one of the changes discussed in §7 is exactly that kind of revision. Alongside them sit the Scottish Dental Clinical Effectiveness Programme (SDCEP) guidance *Drug Prescribing For Dentistry* (3rd edition, January 2016, with a June 2021 update), and the National Institute for Health and Care Excellence (NICE), whose Clinical Guideline 64 governs antibiotic prophylaxis against infective endocarditis. NHS Education for Scotland's *Antibiotic Prophylaxis Against Infective Endocarditis — Implementation Advice* exists to help dental teams put NICE CG64 into practice; it explicitly **does not replace** CG64. SDCEP also publishes a supplementary resource on analgesic and antibiotic contraindications and cautions (developed during the COVID-19 response), and a free *Dental Prescribing* app for Google Play and the App Store.

1.1 Classifying the bacteria

Two classifications matter at the chairside, because between them they predict which drug will work.

By metabolism

Aerobic (require oxygen), **anaerobic** (killed or inhibited by oxygen) and **facultative** (grow either way). Odontogenic infections are characteristically mixed, and the anaerobic component is what makes metronidazole useful.

By staining

Gram-positive (G+), **Gram-negative (G−)** and organisms demonstrated by the **Ziehl–Neelsen (Zn) stain** — the acid-fast mycobacteria, which take neither Gram result.

The Gram result is a statement about cell-wall architecture, and therefore about drug access (Fig. 1). The Gram-positive wall is a thick multilayered peptidoglycan mesh studded with teichoic and lipoteichoic acids, sitting directly on the cell membrane — exposed, and easy for a cell-wall-active drug to reach. The Gram-negative wall has only a thin peptidoglycan layer, but it is buried in a periplasmic space beneath an **outer membrane** carrying lipopolysaccharide (LPS: O-polysaccharide, core polysaccharide and lipid A), lipoproteins, and porins. A drug must cross that outer membrane before it can act, which is precisely the difference between benzylpenicillin and ampicillin (§2).

1.2 Classifying the antibiotics

Antibiotics are described first as bactericidal or bacteriostatic, and the deck ties that division neatly to the target.

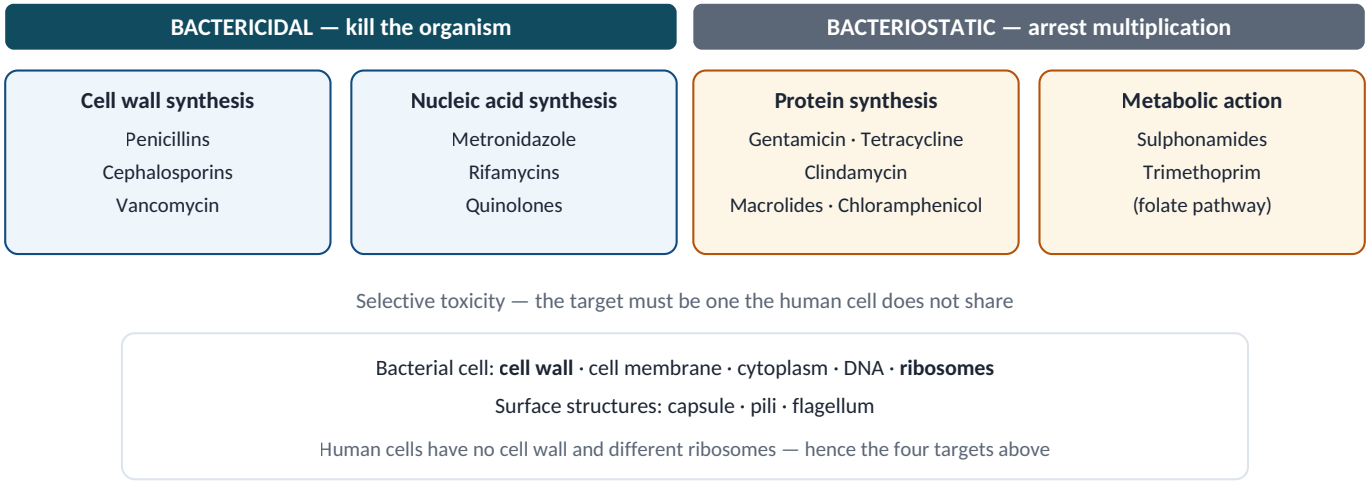

Diagram 1 — The four antimicrobial targets, mapped to bactericidal and bacteriostatic behaviour, with the drug families the lecture assigns to each.

KEY POINTS

Bactericidal drugs attack the **cell wall** or **nucleic acid synthesis**; bacteriostatic drugs attack **protein synthesis** or **metabolic (folate) pathways**. The three cell-wall inhibitors named are, in order, ★**penicillin, cephalosporins and vancomycin**.

§2 Penicillins

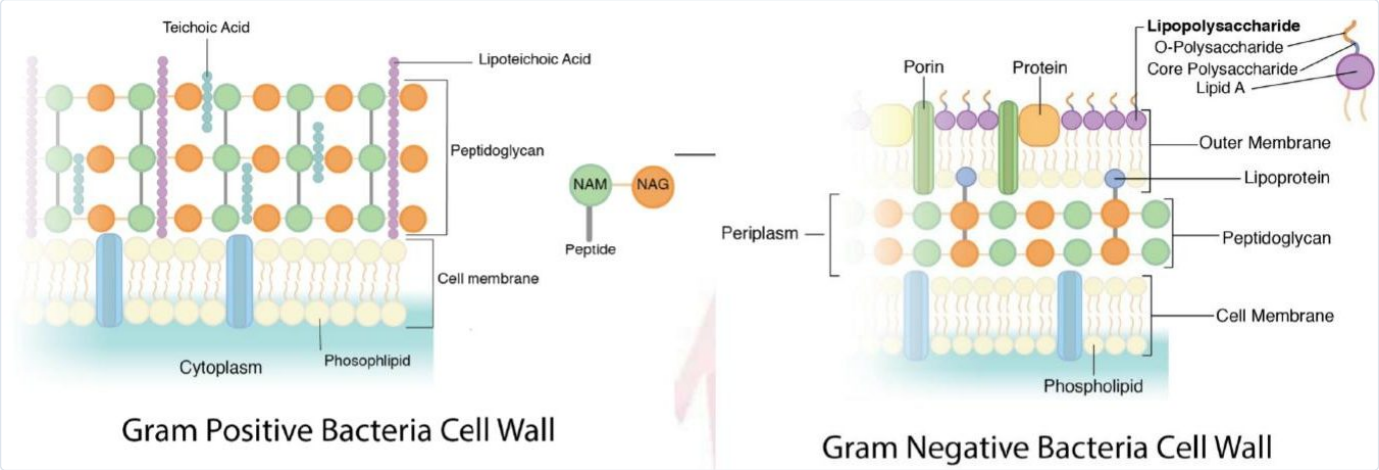

Fig. 1 — Gram-positive versus Gram-negative cell wall. Left: thick peptidoglycan with teichoic and lipoteichoic acids directly on the cell membrane. Centre: the peptidoglycan building block — N-acetylmuramic acid (NAM) and N-acetylglucosamine (NAG) carrying a peptide side chain. Right: thin peptidoglycan in the periplasm, shielded by an outer membrane of lipopolysaccharide, lipoprotein and porins. Cell-wall-active drugs must first reach the peptidoglycan.

2.1 Structure and mechanism

Penicillins belong to the **β-lactam family**, named for the four-membered β-lactam ring fused to the thiazolidine ring of the penicillin nucleus; the R group on the side chain is what distinguishes one penicillin from another. The ring is both the business end of the molecule and its weak point (§3).

Penicillins interfere with bacterial cell wall synthesis by **destroying the peptide link** between adjacent peptidoglycan strands. The enzyme responsible for making that link is **transpeptidase (TP)**, better known in this context as the **penicillin-binding protein (PBP)**.

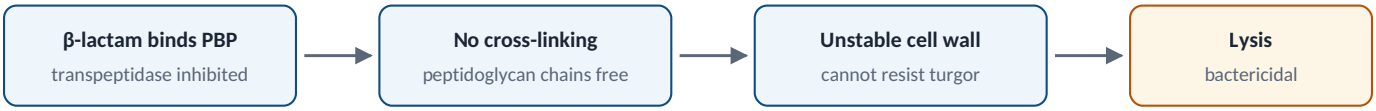

Diagram 2 — The four-step β-lactam mechanism as the lecture sets it out. Because the end point is lysis rather than arrest, penicillins are bactericidal.

2.2 The individual agents

Benzylpenicillin (penicillin G) is the natural penicillin: narrow spectrum, acting mostly against Gram-positive organisms. It is **inactive orally** because it is destroyed in an acidic medium, so it is given parenterally (the depot form illustrated is benzathine benzylpenicillin 1,200,000 IU, for intramuscular injection only). It is **well bound to plasma protein** — bound drug is not free to act — and it is **not a Dental Practitioners' Formulary (DPF) prescribable antibiotic**. The deck states that it crosses the blood–brain barrier.

Phenoxymethylpenicillin (penicillin V) is the oral equivalent of penicillin G with the **same spectrum**. It is **active in an acidic medium** and therefore survives gastric juice, and it is **less protein-bound** than penicillin G, leaving more free drug and making it, in the lecture's phrase, more effective. This is the agent that returns in §7 as first-line for acute dental infection.

Ampicillin is the ★**first broad-spectrum penicillin**. Its advance is the ability to **penetrate the outer membrane of the Gram-negative cell wall**, which benzylpenicillin cannot do. It is **not preferred orally** — absorption is incomplete and food-dependent.

Amoxicillin has the **same spectrum as ampicillin** but far better oral bioavailability; it can be given orally or by injection, and is the ★**most commonly used** penicillin in dentistry.

Table 1 — The four penicillins compared

	Benzylpenicillin (G)	Phenoxymethylpenicillin (V)	Ampicillin	Amoxicillin
Spectrum	Narrow, mostly G+	Narrow, same as G	Broad (first broad-spectrum)	Broad, as ampicillin
Route	Parenteral only	Oral	Oral not preferred	Oral or injection
Acid stability	Inactivated by acid	Active in acid	Acid-stable	Acid-stable
Plasma protein binding	High	Lower — more free drug	—	—
Dental note	Not DPF-prescribable; natural agent	First-line for acute dental infection	Superseded orally by amoxicillin	Most commonly used

2.3 Adverse effects of the penicillins

The dominant problem is **allergy**, ranging from rashes to anaphylaxis. A rash appearing after aminopenicillin (ampicillin or amoxicillin) exposure in a patient with infectious **mononucleosis** is the classic non-allergic drug eruption, and does not by itself establish true penicillin allergy. The deck gives ★**10% cross-allergenicity with cephalosporins** — the traditional teaching figure, and the number an examiner is most likely to want. It also states that penicillins interfere with the action of oral contraceptives.

★ EXAM PEARL

Two of the numbers on this slide are worth knowing in both versions. The classic **10% penicillin–cephalosporin cross-reactivity** is now regarded as a considerable over-estimate — modern series put it nearer **1–2%**, and lower still for third- and fourth-generation agents, because cross-reactivity tracks the R1 side chain rather than the β-lactam ring itself. Likewise, current UK guidance no longer regards non-enzyme-inducing antibacterials (including the penicillins) as reducing the efficacy of combined oral contraceptives; additional precautions are advised only if vomiting or diarrhoea occurs. Answer 10% if the paper is quoting the deck, but know why it is wrong.

CAUTION

Do not prescribe a penicillin to a patient with a history of **anaphylaxis, urticaria or rash occurring immediately after** penicillin administration — these patients are at risk of immediate hypersensitivity (SDCEP). Penicillins can also cause diarrhoea.

§3 Resistance: β-lactamases, inhibitor combinations and MRSA

The β-lactam ring is the target of the bacterial counter-attack. **β-lactamase** enzymes — of which the extended-spectrum β-lactamases (**ESBL**) are the most troublesome — hydrolyse the ring, converting penicillin to the inactive **penicilloic acid**. Once the ring is open the drug can no longer bind the penicillin-binding protein, and the organism is resistant.

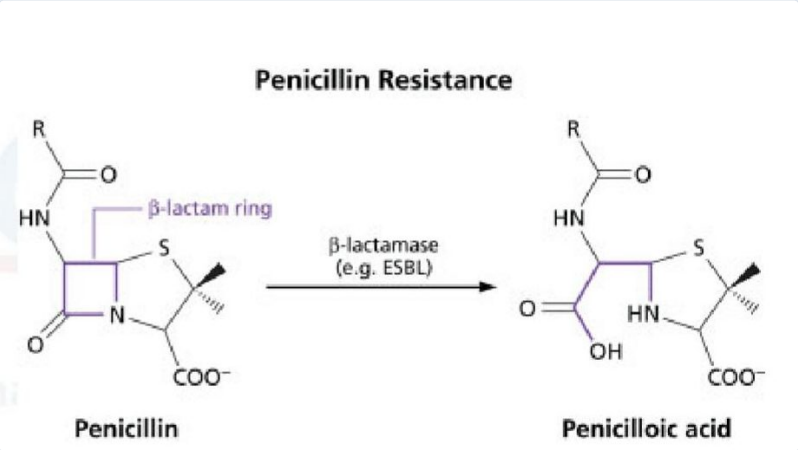

Fig. 2 — Penicillin resistance. β-lactamase (e.g. ESBL) hydrolyses the β-lactam ring, opening it to give penicilloic acid. The intact ring is essential for activity, so ring cleavage abolishes it.

There are two pharmacological answers to β-lactamase: protect the drug with an inhibitor, or redesign the side chain so the enzyme cannot reach the ring.

3.1 β-lactamase inhibitor combinations

Clavulanic acid and sulbactam have negligible antibacterial activity of their own; they act as suicide substrates, occupying the β-lactamase so the partner penicillin survives.

Table 2 — β-lactamase inhibitor combinations and their strengths

	Amoxicillin + clavulanic acid (co-amoxiclav, Augmentin)	Ampicillin + sulbactam (Unacin)
Usual route	Most commonly oral; an intravenous formulation exists	Most commonly intramuscular, but may be oral
Adult strengths	500 mg amoxicillin + 125 mg clavulanate = **625 mg** 875 mg + 125 mg = **1000 mg**	500 mg ampicillin + 250 mg sulbactam = **750 mg** 1000 mg + 500 mg = **1500 mg**
Paediatric strength	250 mg + 125 mg = **375 mg**	250 mg + 125 mg = **325 mg**

> **CAUTION**
> Co-amoxiclav must **never** be given by intramuscular injection — it causes **muscle necrosis**. Oral or intravenous only.

3.2 Penicillinase-resistant (anti-staphylococcal) penicillins

The alternative strategy is a bulky side chain that sterically shields the β-lactam ring. These agents — **methicillin**, nafcillin, oxacillin, dicloxacillin, cloxacillin and **flucloxacillin** — are also called the **semisynthetic** or **penicillinase-resistant** penicillins, and are all ★**β-lactamase stable**. They exist for the staphylococcus, which is a prolific β-lactamase producer. The combination product **Flumox** is amoxicillin plus flucloxacillin, pairing broad spectrum with staphylococcal cover.

3.3 MRSA and the resistance vocabulary

MRSA is **methicillin-resistant *Staphylococcus aureus***. The resistance mechanism is not β-lactamase but an altered penicillin-binding protein, and its practical consequence is resistance to ★**all β-lactam antibiotics** — every penicillin, every cephalosporin, and the inhibitor combinations too. The lecture identifies the typical patient as an **in-patient**, on prolonged treatment or following surgery.

Vancomycin may help in these cases; when an organism defeats vancomycin as well the term is **VRSA** (vancomycin-resistant *S. aureus*). Such patients are then treated with several antibiotics simultaneously, and organisms resistant across multiple classes are described as **MDR** — multi-drug resistant.

> **★ EXAM PEARL**
> The "M" in MRSA is historical. **Methicillin is no longer used clinically** — it survives only as the name of the phenotype and, in the laboratory, as oxacillin or cefoxitin used for susceptibility testing. Clinically the class is represented by **flucloxacillin**. If a stem describes a patient "taking methicillin", read it as the anti-staphylococcal penicillin class.

§4 The other cell-wall agents: cephalosporins and vancomycin

4.1 Cephalosporins

Cephalosporins are **β-lactams** and therefore inhibit cell wall synthesis by the same mechanism as the penicillins. They are broad-spectrum and come in **four generations**, but are of **little value in dental practice** — they add nothing against the oral flora that penicillin V, amoxicillin or metronidazole do not already cover, while broadening the collateral damage.

Two rules govern the generations, and both have the same exception:

- All generations are more active against **Gram-negative** than Gram-positive organisms — ★**except the 1st generation**, which is the Gram-positive one.
- All generations are **β-lactamase resistant** — ★**except the 1st generation**.

Table 3 — Cephalosporin generations and exemplar agents

Generation	Example	Gram bias	β-lactamase
1st	Cephradine	More active against G+	Not resistant
2nd	Cefoxitin	More active against G−	Resistant
3rd	Cefotaxime (Cefotax, 1 g IM/IV)	More active against G−	Resistant
4th	Cefozopran	More active against G−	Resistant

The unwanted effects are **10% cross-allergenicity with penicillin** (the same figure from the other side — see the pearl in §2), **renal failure**, and **diarrhoea with abdominal cramps**.

4.2 Vancomycin

Vancomycin is a **glycopeptide**, not a β-lactam, and it inhibits cell wall synthesis one step earlier than penicillin does. Rather than inhibiting the enzyme, it **binds the building blocks themselves** — the NAM and NAG units of peptidoglycan — so that transpeptidase cannot act on the newly formed blocks and **cross-linking of the peptidoglycan layer** never happens. Because its target is the peptidoglycan substrate, and because it is a large molecule that cannot cross the Gram-negative outer membrane, it is **especially effective against Gram-positive bacteria**, including resistant strains of MRSA.

> **KEY POINTS**
> Vancomycin is the ★**drug of last resort** — reserved for when all other treatments have failed. It is given by **slow intravenous injection in hospital** for MRSA, but **orally** for antibiotic-associated colitis, where the point is precisely that it is not absorbed and stays in the gut lumen. It is the **treatment of choice for antibiotic-associated colitis**.

4.3 Antibiotic-associated colitis

Long-term antibiotic use — the deck names **clindamycin (Dalacin C)** and **tetracycline** in particular — destroys the normal flora of the gastrointestinal tract. An opportunistic infection by ***Clostridium difficile*** then takes hold and causes colitis. **Oral vancomycin inhibits *C. difficile***; where vancomycin is contraindicated, metronidazole does the same job (§5).

Note: the slide lists "Dalacin C, tetracycline and clindamycin" as three agents — Dalacin C *is* clindamycin, so the list is really two drugs.

> **CAUTION**
> Vancomycin is **ototoxic** and **nephrotoxic**, and causes **phlebitis at the injection site**. **Teicoplanin** is a similar glycopeptide — safer, but more expensive.

§5 Drugs acting on nucleic acid and on folate metabolism

5.1 Inhibitors of nucleic acid synthesis

Three families are named: **metronidazole**, the **rifamycins** (rifampicin) and the **quinolones**. Their common property is **selective toxicity**: they act on bacterial nucleic acid machinery, and — as the deck puts it — cannot bind eukaryotic RNA polymerase, so human transcription is untouched.

Strictly, that RNA-polymerase statement describes rifampicin. Metronidazole is reduced inside anaerobes to a nitro radical that fragments bacterial DNA directly, and the quinolones inhibit DNA gyrase and topoisomerase IV. The principle — a bacterial-only nucleic acid target — holds for all three.

5.2 Metronidazole

Metronidazole (Flagyl, 500 mg film-coated tablets) is the anaerobic agent, and that single property explains its whole dental role.

- Active against **anaerobic bacteria** — hence its use in **pericoronitis** and necrotising ulcerative gingivitis, both driven by anaerobes.
- **Antamoebic** and **antiprotozoal**.
- Inhibits ***C. difficile*** where vancomycin is contraindicated.
- Combined with **amoxicillin** in **aggressive periodontitis** and **ANUG** — the pairing covers the aerobic and anaerobic halves of the flora (doses in §7).

> **CAUTION**
> Metronidazole cautions, all four of them examinable: **nausea and vomiting**; a ★**disulfiram-like reaction with alcohol** — patients must be told to avoid alcohol; **interference with warfarin**, potentiating anticoagulation, so it is not prescribed to patients taking warfarin; and a persistent **metallic taste**, on which basis the lecture contraindicates it in breast feeding, at least during the first six months. It is not licensed for children under 1 year.

5.3 Inhibitors of metabolic action: the folate pathway

Two agents block bacterial folate metabolism: the **sulphonamides** and **trimethoprim**. Bacteria must synthesise folate *de novo*, whereas human cells take it up ready-made from the diet — that difference is the selective toxicity. Sulphonamides are structural analogues of para-aminobenzoic acid (PABA) and compete for its incorporation into folate; the lecture also credits them with decreasing cell membrane permeability. They are **contraindicated in pregnancy and in folate deficiency**.

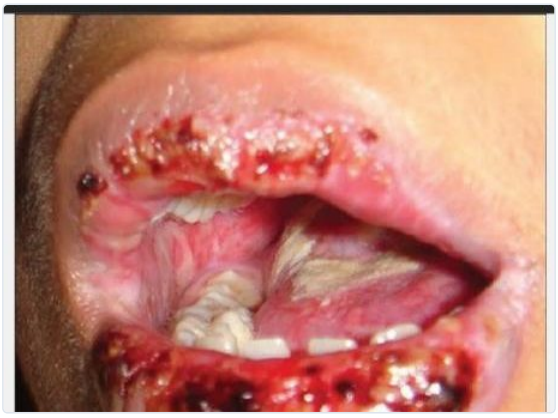

Fig. 3 — Haemorrhagic crusting of the lips with widespread mucosal ulceration: the oral presentation of erythema multiforme / Stevens–Johnson syndrome, a recognised sulphonamide reaction. The lips are the classic site, and the appearance should prompt an immediate drug history.

Adverse effects run from the trivial to the life-threatening: **allergy, headache and vomiting**; **haemolytic anaemia**; and ★**erythema multiforme and Stevens–Johnson syndrome**.

> ★ EXAM PEARL
> Stevens–Johnson syndrome appears twice in this lecture, from two unrelated drug groups — **sulphonamides** here and **HAART** in §9. If a stem offers a patient with crusted, bleeding lips and oral ulceration, the answer is a drug reaction until proved otherwise, and the drug history is the diagnostic test.

§6 Inhibitors of protein synthesis

Four agents head the list — **gentamicin, tetracycline, clindamycin and erythromycin** — to which chloramphenicol and the remaining macrolides are added. All are bacteriostatic in the lecture's scheme, arresting multiplication rather than killing outright, which is why they depend on a competent host immune response.

6.1 Gentamicin

An aminoglycoside, used in dentistry and general practice mainly as a **topical preparation — drops or ointments**. Systemically it is **ototoxic** and **nephrotoxic**, the same toxicity pair as vancomycin.

6.2 Chloramphenicol

A **potent broad-spectrum** antibiotic, encountered principally as **topical antibacterial eye drops**. Systemically it is reserved for **typhoid fever, in hospital**, because of two severe adverse effects: ★**aplastic anaemia** and **grey baby syndrome** in neonates.

6.3 Tetracycline

Broad-spectrum, available for both **oral and topical use**. Its topical dental applications are worth memorising as a set: **recurrent aphthous ulceration (RAU)** — as a mouthwash made from the capsule contents; **deep periodontal pockets**; and **triple antibiotic paste** as an intracanal medicament.

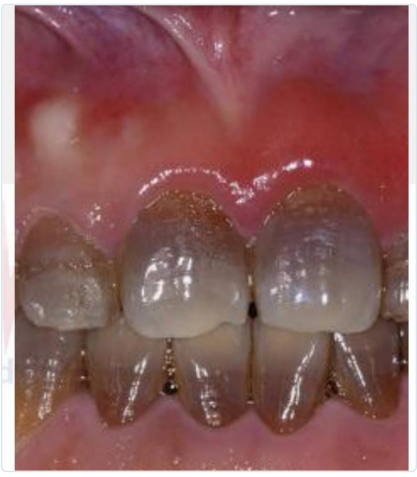

Fig. 4 — Intrinsic tetracycline staining: grey-brown banded discoloration of the permanent dentition, worst in the cervical third where the crown was mineralising at the time of exposure. The change is permanent and lies within the dentine, so it does not respond to external bleaching in the way extrinsic stain does.

The adverse effects are four:

1. **Chelation.** Food or drugs containing **calcium, iron, aluminium or magnesium** chelate tetracycline, and the chelate is not absorbed — so it must be taken **before food and without any accompanying drug**.
2. **Teratogenic discoloration** of developing teeth and bone, hence ★**contraindicated in children under 12 and in pregnancy**.
3. **Opportunistic infection** by *Candida* and clostridia (see antibiotic-associated colitis, §4).
4. **Hypersensitivity.**

6.4 Clindamycin

A potent broad-spectrum lincosamide, active against **Gram-positive and Gram-negative** organisms and against **aerobes and anaerobes** alike. Its distinguishing property is a **high power of diffusion through hard and soft tissues** — which is why it is the ★**treatment of choice in osteomyelitis** (refer to a specialist) and in **parotid abscess**, and why it is used as **single-dose prophylaxis against infective endocarditis** in the penicillin-allergic patient. It is dispensed as Clindam or **Dalacin C** (150 mg capsules; 600 mg film tablets), at **300 mg three times daily for 5 days** in adults and **100 mg three times daily for 5 days** in children.

> **CAUTION**
> Clindamycin causes **antibiotic-induced colitis**, so it is prescribed together with metronidazole (Flagyl). Given by **rapid intravenous injection** it causes **hypotension and cardiac arrest**, and must therefore be given by **slow infusion**.

6.5 Macrolides

The macrolides are **azithromycin, erythromycin and clarithromycin**. They have a **spectrum similar to penicillin but are bacteriostatic** rather than bactericidal, and their role in dentistry follows directly from that similarity: they are the **alternative to penicillin in the penicillin-allergic patient**. They are otherwise very safe, with few side effects — nausea, vomiting and gastrointestinal upset.

SDCEP note: **clarithromycin tablets are not licensed in children under 12 years**; prescribe the oral suspension for that age group.

6.6 Cross-class cautions — pulled together

The lecture scatters its contraindications across many slides. Collected, they form a short list that covers most of what a prescribing station can ask.

Table 4 — Cross-class prescribing cautions

Situation	Avoid	Reason
Pregnancy	**Tetracycline · chloramphenicol · metronidazole** (also sulphonamides, azoles)	Tooth and bone discoloration; grey baby syndrome; lecture's list of agents contraindicated in pregnancy
Breast feeding	Metronidazole (at least first 6 months)	Metallic taste transferred to milk
Children <12 years	Tetracycline; clarithromycin *tablets* (suspension instead)	Permanent staining of developing teeth; licensing
Warfarin	Metronidazole; systemic fluconazole; topical miconazole	Potentiation of anticoagulation — MHRA reminder, June 2016
Statins	Systemic fluconazole; topical miconazole	Azole inhibition of statin metabolism
Alcohol	Metronidazole	Disulfiram-like reaction
Renal / auditory risk	Gentamicin; vancomycin	Ototoxic and nephrotoxic
Prior colitis	Clindamycin; tetracycline	*C. difficile* overgrowth

§7 Antimicrobial prescribing in general dental practice

> **KEY POINTS**
> The first line of dealing with infection is ★**establishing drainage, not antibiotics**. Antibiotics are indicated only as an **adjunct to drainage**, where there are **systemic manifestations of infection** or where **drainage cannot be achieved**. In those cases also ensure **fluid intake and bed rest**.

7.1 Systemic manifestations of infection

These are the findings that convert a local problem into a prescribing decision, and several of them are simultaneously referral criteria:

- **Diffuse swelling · eye closure · trismus · dysphagia**
- **High body temperature · airway obstruction**
- **Failure to respond to treatment**

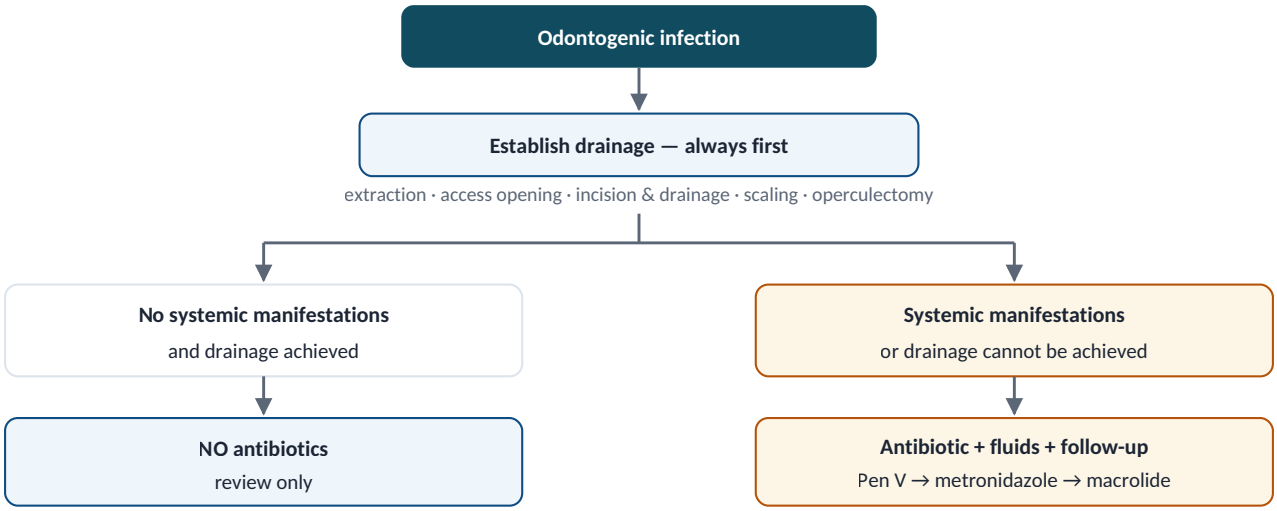

Diagram 3 — The prescribing decision in general dental practice. Drainage is not one option among several; it is the treatment, and the antibiotic is the adjunct.

7.2 The four clinical scenarios

The antibiotic ladder is the same wherever systemic involvement exists: ★**penicillin V first; metronidazole second if penicillin is contraindicated; a macrolide third** when both are contraindicated. What differs between scenarios is the means of drainage and the short list of exceptions in which an antibiotic is used without systemic signs.

Table 5 — Antimicrobial management by clinical scenario

Scenario	No systemic manifestations	With systemic manifestations
Acute dento-alveolar infection	Drainage only — **extraction**, **access opening**, or **incision and drainage**. **No antibiotics.**	Drainage + antibiotics (Pen V → metronidazole → macrolide) + fluids + follow-up
Chronic dento-alveolar infection	Drainage only. **No antibiotics.**	
Periodontal infection	Drainage by **scaling and root surface debridement**, **incision of a periodontal abscess**, or **extraction**. No antibiotics **except** the three exceptions below.	
Pericoronitis	**First episode:** drainage by **hydrogen peroxide irrigation and operculectomy**; no antibiotics. **Second episode: extraction of the wisdom tooth**; no antibiotics.	The same management, **with metronidazole**

The three periodontal exceptions, in which an antibiotic is given even without systemic involvement, are:

- **ANUG** — ★**metronidazole 400 mg three times daily for 3 days**.
- **Aggressive periodontitis** — refer to a specialist, who will prescribe **amoxicillin 250 mg three times daily for 7–10 days with metronidazole 200 mg three times daily for 7–10 days**.
- **Chronic periodontitis not responding to treatment** — refer to a specialist, who may prescribe a **sub-optimal (sub-antimicrobial) dose of tetracycline**, given for its host-modulating anti-collagenase effect rather than to kill bacteria.

7.3 Current SDCEP regimens

The lecture names the drugs but not, for the most part, the doses. The uploaded SDCEP *Drug Prescribing For Dentistry* June 2021 update supplies them, and also revises two things the older editions taught.

KEY POINTS

Following the Scottish Antimicrobial Prescribing Group statement of October 2020, **phenoxymethylpenicillin is the preferred first-line antibiotic** for acute dento-alveolar infection — chosen over amoxicillin for its **narrower spectrum**, which is less likely to drive antimicrobial resistance. Antibiotic therapy is appropriate only if immediate drainage is not achieved by local measures, or where there is spreading infection or systemic involvement. **Amoxicillin remains an appropriate alternative where compliance with four-times-daily dosing is a concern.**

Table 6 — SDCEP regimens (June 2021 update)

Indication	Adult regimen	Children
Acute dento-alveolar infection (first line)	**Phenoxymethylpenicillin 500 mg four times daily for 5 days.** Swallow each tablet whole with water, at least **30 minutes before food** — food slightly reduces absorption.	Doses per SDCEP p.31 / BNFC
Dental abscess, penicillin-allergic	**Metronidazole 400 mg tablets — send 15 — one tablet three times daily (5 days).**	1–2 y: 50 mg tds · 3–6 y: 100 mg bd · 7–9 y: 100 mg tds · 10–17 y: 200 mg tds
Necrotising ulcerative gingivitis and pericoronitis	**Metronidazole 400 mg tablets — send 9 — one tablet three times daily (3 days).**	As above (metronidazole not licensed under 1 year)
Sinusitis (acute)	Local measures first; antibiotic only for persistent or severe symptoms. **Phenoxymethylpenicillin 250 mg tablets — send 40 — two tablets four times daily (5 days). Doxycycline** if penicillin-allergic or intolerant.	6–11 mo: 62.5 mg qds · 1–5 y: 125 mg qds · 6–11 y: 250 mg qds · 12–17 y: 500 mg qds
Severe infection	**Double** the adult phenoxymethylpenicillin dose.	Up to 11 y: increase to 12.5 mg/kg qds · 12–17 y: up to 1 g qds

★ **EXAM PEARL**

Three changes in this update are exactly the sort a paper tests. **Phenoxymethylpenicillin, not amoxicillin, is now first line** for acute dento-alveolar infection *and* for acute sinusitis (NICE CG67) — amoxicillin is **no longer recommended** for sinusitis at all. And the adult metronidazole dose was **increased to 400 mg tds in BNF 73 (March 2017)**: 15 tablets for an abscess (5 days), 9 tablets for NUG or pericoronitis (3 days). If a stem quotes 200 mg tds for an adult, it is quoting a pre-2017 formulary.

The same SDCEP update revises the medical-emergency drug box for **hypoglycaemia**: glucagon 1 mg by intramuscular injection in adults; in children, 0.5 mg for 2–8 years with bodyweight under 25 kg, and 1 mg for 9–17 years with bodyweight 25 kg or over.

§8 Prophylactic antibiotics and infective endocarditis

Prophylaxis is a separate decision from treatment, and the indications are narrow.

- **Healthy patients:** prophylaxis is restricted to cases of ★**oro-antral communication**.
- **Medically compromised patients:** those with **immunosuppression**, those with **uncontrolled diabetes mellitus**, and those **at high risk of infective endocarditis who are undergoing a high-risk dental procedure**.

That last indication requires two independent judgements — is *this patient* high risk, and is *this procedure* high risk? Prophylaxis is considered only where both answers are yes.

Table 7 — Infective endocarditis: patient risk × procedure risk

	High risk	Low risk
Patient	**Replacement of a heart valve** **Previous episode of infective endocarditis**	Any other patient — **including patients with pacemakers**
Procedure	Procedures **with bleeding**: extraction, surgery, implant placement, scaling	Procedures **without bleeding**, e.g. restorative work

KEY POINTS

NICE Clinical Guideline 64 was amended in 2016 to insert one word: ★**"Antibiotic prophylaxis against infective endocarditis is not recommended *routinely* for people undergoing dental procedures."** SDCEP published implementation advice in 2018. The amendment was not intended to change practice: the **vast majority** of patients at increased risk will **not** be prescribed prophylaxis. For a very small number it may be prudent to consider prophylaxis as **non-routine management**, in consultation with the patient and their **cardiologist or cardiac surgeon**.

★ EXAM PEARL

The examinable subtlety is the word "routinely", and the decision-maker. A dentist does not unilaterally decide to give endocarditis prophylaxis; the non-routine pathway runs through the patient's cardiologist. Note also the deck's own trap — a **pacemaker is low risk**, despite being an obvious-looking cardiac implant. Where prophylaxis is agreed for a penicillin-allergic patient, **clindamycin** is the single-dose alternative (§6).

§9 Antifungal and antiviral therapy

9.1 The principle

The commonest oral fungal infection is ***Candida albicans***. Candida is characteristically an **opportunistic** infection — the "disease of the diseased" — affecting patients whose resistance is lowered. It follows that the ★**first line of treatment is to identify and treat the cause of the low resistance**, and only then to prescribe an antifungal. A denture never cleaned, an uncontrolled diabetic, a steroid inhaler used without rinsing, an undiagnosed anaemia or an immunocompromising illness will each defeat any antifungal prescribed in isolation.

Table 8 — Antifungal agents

Agent	Form and dose	Notes
Nystatin (Mycostatin)	**Topical only.** Oral suspension 100,000 units/ml — drops for children, gel for adults (mucostatin gel). **1 ml four times daily, continued until 2 days after healing.**	**Highly safe → first choice in children.** Not absorbed from the gut, so it acts only where it touches.
Miconazole 24 mg/ml (Daktarin oral gel)	**10 ml applied near the lesion four times daily, until 2 days after healing** (the deck's dose — see §11).	**Best choice for angular cheilitis**, being active against **streptococci, staphylococci and candida** — the mixed flora of the commissures. As with any azole, **contraindicated with warfarin, statins and in pregnancy**.
Fluconazole	**50 mg tablet once daily for 7–14 days**, or 50 mg/5 ml suspension once daily for 7–14 days, or **IV 200–400 mg once daily for 7–14 days**.	Systemic. For **severe infection**; **second line to topical preparations**. Same warfarin and statin interaction.
Amphotericin B	Topical (vaginal), oral, intramuscular or intravenous; orange flavoured.	The lecture limits it to **genital infection** and states it is **not for oral infection**.

CAUTION

MHRA reminder, June 2016: the interaction between **miconazole oral gel and warfarin** can have serious consequences. Neither **systemic fluconazole** nor **topical miconazole** should be prescribed to patients taking **warfarin or statins**. An up-to-date medical history is what makes this rule usable — the gel feels harmless precisely because it is topical.

9.2 Antivirals

Aciclovir treats **herpes simplex** and **herpes zoster** infections. Its timing is everything: it is worthwhile ★**only in early lesions during the prodromal phase, or in immunocompromised patients**. Once vesicles are established and viral replication has peaked, an antiviral changes little.

Table 9 — Aciclovir regimens as given in the lecture

	Immunocompetent	Immunocompromised
Herpes simplex	**200 mg five times daily for 5 days**	**400 mg five times daily for 5 days**
Herpes zoster	**400 mg five times daily for 7 days**	**800 mg five times daily for 7 days**

The pattern is easy to hold: simplex 5 days, zoster 7 days; doubling the dose for the immunocompromised patient. Topical aciclovir 5% cream is available for labial lesions.

9.3 Occupational exposure and HIV

Zidovudine is used for **post-exposure prophylaxis (PEP)** after occupational exposure. **HAART — highly active anti-retroviral therapy** — is the complex combination of drugs that slows progression of HIV infection and reduces viral load, and is also used for PEP. Two of its effects present orally: **dry mouth** and **Stevens–Johnson syndrome**.

§10 Analgesics

Three drugs, distinguished by three properties: anti-inflammatory action, gastric effect, and effect on bleeding. Get those three straight and the comparison answers itself.

Table 10 — Aspirin, ibuprofen and paracetamol compared

	Aspirin	Ibuprofen	Paracetamol
Analgesic	Yes — mild to moderate pain	Yes	Yes
Antipyretic	Yes	Yes	Yes
Anti-inflammatory	Yes	Yes	**No**
Gastric effect	Stomach ulceration, gut irritation	**Less** gut irritant than aspirin	**No** gastric irritation
Bleeding	**Blood thinner**	**Not** a blood thinner	**No** interference with bleeding time
Key contraindication	**Reye syndrome** in children (the deck says under 12 — see §11)	Otherwise as aspirin	—

★ EXAM PEARL

Paracetamol is the safe default in dentistry precisely because of the three "no"s in the last column — no anti-inflammatory action, but also **no gastric irritation and no effect on bleeding time**. That makes it the analgesic of choice after extraction in a patient taking an anticoagulant, or with a history of peptic ulceration. Ibuprofen occupies the middle ground: aspirin's efficacy without aspirin's antiplatelet effect.

§11 Where this deck differs from current UK guidance

Several statements in the lecture are traditional teaching that current formularies have moved past. They are collected here so that neither version catches you out: know the deck's answer for the deck's exam, and the current answer for the clinic.

Table 11 — Lecture statement versus current standard

	The lecture says	Current UK position
Aspirin and Reye syndrome	Avoid in children under **12**	BNF: avoid in children under **16** years (except in specific indications such as Kawasaki disease)
Aciclovir for herpes zoster	**400 mg** five times daily for 7 days	BNF: **800 mg** five times daily for 7 days in immunocompetent adults
Penicillin–cephalosporin cross-allergy	**10%**	Nearer **1–2%**; determined by R1 side-chain similarity, not the β-lactam ring
Penicillins and oral contraceptives	Interfere with contraceptive action	Non-enzyme-inducing antibacterials are **no longer** considered to reduce combined oral contraceptive efficacy; extra precautions only if vomiting or diarrhoea
Miconazole oral gel dose	**10 ml** near the lesion four times daily	Adult oral candidosis: **2.5 ml** four times daily, held in the mouth after food — verify against the BNF before prescribing
Sulphonamide mechanism	Decrease cell membrane permeability; inhibit folate metabolism	Competitive inhibition of **dihydropteroate synthase** (PABA analogue) in folate synthesis; the permeability claim is not the accepted mechanism
Metronidazole / quinolone mechanism	Cannot bind eukaryotic RNA polymerase	True of **rifampicin**. Metronidazole is reduced to a DNA-damaging nitro radical; quinolones inhibit DNA gyrase and topoisomerase IV
Benzylpenicillin and the CNS	Can pass the blood–brain barrier	Penetration is **poor** unless the meninges are inflamed — which is when it is used
Amphotericin B	Limited to genital infection	Principally an **intravenous** agent for systemic mycoses; oral lozenges and suspension were discontinued in the UK
Methicillin	In-patients "taking methicillin"	Methicillin is **no longer used clinically**; flucloxacillin is the clinical agent, oxacillin/cefoxitin the laboratory markers