

Prevention & Community: Dental Caries

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EXAM-DAY SUMMARY

everything on this page → detail in \$\$ overleaf

CARIES PROCESS → §1

- Sugar-dependent infectious disease
- CHO → plaque bacteria → acids → ↓pH → Ca & PO₄ out of enamel
- Lesion only when demin > remin

FACTORS TO CONTROL → §1

- Triad: host (teeth) · bacteria · substrate
- 4 controllable: bacterial · substrate · tooth · time
- Bacteria = mutans strep + lactobacilli; substrate = sucrose, fructose

DIAGNOSIS → §2

- Best radiograph = bitewing
- 40–50% demineralisation needed before radiographic detection
- True depth > radiographic depth
- Blunt probe, horizontal dredge · loupes · FOTI · DIAGNOdent · dyes

PREVENTION STAGES & RISK → §3

- 1° = caries doesn't occur · 2° = incipient, not cavitated · 3° = established lesion
- High risk: new lesions · premature XLA · anterior restorations · multiple/repeat restorations · no sealants · multi-band ortho

ORGANISMS → §4

- *S. mutans* G+ cocci, enamel, initiation
- Lactobacillus G+ bacilli, dentin, survives low pH
- Actinomyces — root caries, xerostomia

PLAQUE CONTROL → §4

- Brush twice daily; not right after meals (low pH)
- Rinse after eating → buffers pH, washes acids
- Chlorhexidine bactericidal + fungicidal → taste disturbance, staining

DIET → §5

- Diet = most important factor in caries; OH = most important in perio
- Poor OH only a secondary caries factor
- Non-milky extrinsic sugars most cariogenic; milky, intrinsic less; starch not readily broken down

DIET ANALYSIS & ADVICE → §5

- 3–4 consecutive days, ≥1 weekend day; time, content, quantity
- Check brushing + bed time
- Sweets in one day · all-in-one > packets · fruit > juice · no artificial sugars pre-school

FLUORIDE: MECHANISM & SYSTEMIC → §6

- Hydroxyapatite → fluorapatite → ↓ mineral solubility
- Systemic = pre-eruptive · topical = post-eruptive
- Water 1 ppm; best for smooth surface caries; UK 10% covered
- Milk 2.5–7 ppm · supplements to age 16 / last tooth, high risk + non-fluoridated water

SUPPLEMENT SCHEDULE → §6

- Water >0.6 ppm → no supplements at any age
- <0.3 ppm: 0–6 m none · 6 m–3 y 0.25 · 3–6 y 0.50 · 6–16 y 1.0 mg/day
- 0.3–0.6 ppm: 3–6 y 0.25 · 6–16 y 0.50 mg/day

TOPICAL FLUORIDE → §6

- Varnish: Duraphat 5% NaF = 2.26% F⁻ · difluorosilane 1% = 0.1% F⁻ · SDF 38% = 5% F
- Max 4×/year; 2× low risk, 4× (3-monthly) high risk
- C/I: allergy · ulcerative gingivitis · ANUG · stomatitis. No brushing 30 min
- APF gel 1.23%; rinse 0.05% NaF = 0.023% F, not under 8

CONCENTRATIONS & TOXICITY → §6

- % × 10 = mg/mL; × 1000 = ppm → varnish 22,600 ppm; APF 12,300 ppm
- Paste 1,000 ppm = 1 mg/mL · 1,500 ppm = 1.5 mg/mL
- STD 1 · PLD 5 · CLD 32–64 mg/kg
- <5 milk + observe · 5–15 medical attention · >15 hospital, IV calcium, cardiac monitoring

SEALANTS & GUIDELINE GATES → §7 §8

- 90% of caries in pits and fissures; light-cured flowable composite; low-viscosity GI = equal effect
- Paste: smear <3 y (≥1,000 ppm) · pea 3–6 y (>1,000) · 1,350–1,500 from 7
- Varnish 2×/yr all from 3 y (2.2% NaF); 2+ if concern
- Age gates: 8 → daily rinse · 10 → 2,800 ppm · 16 → 2,800/5,000 ppm

§1 The caries process

KEY POINTS

Caries = sugar-dependent infectious disease. Plaque bacteria metabolise dietary carbohydrate → acid byproducts → pH drop → Ca & PO₄ diffuse **out** of enamel. Lesion appears only when demineralisation outweighs remineralisation.

- **Definition:** sugar-dependent **infectious** disease — not simply "dissolution by acid"
- **Acid production:** dietary carbohydrate → metabolised by plaque bacteria → byproducts (acids)
- **Mineral loss:** drop in pH → calcium & phosphate diffuse out of enamel
- **Onset:** enamel constantly cycles demineralisation ⇌ remineralisation → caries starts only when the balance **tips to demineralisation**

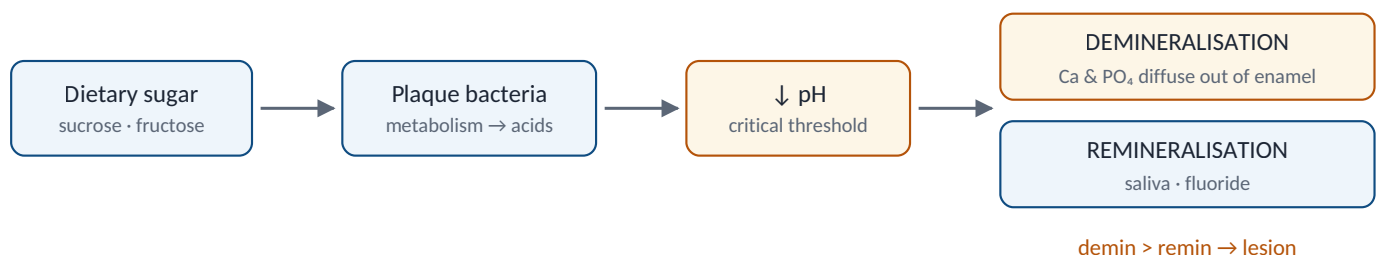


Diagram 1 — The caries equation: sugar → bacterial acid → pH drop → mineral loss. Lesion forms only when demineralisation outweighs remineralisation.

1.1 Factors involved in initiation

- **Three overlapping circles:** **host** (teeth) + **bacteria** (mutans streptococci, lactobacilli) + **substrate** (fructose, sucrose) — caries sits where all three overlap
- **Four controllable factors:** 1 bacterial · 2 substrate · 3 tooth · 4 **time** ★4 factors, not 3
 - time = duration/frequency of the acid challenge → controlled through **frequency** of sugar intake (see §5)

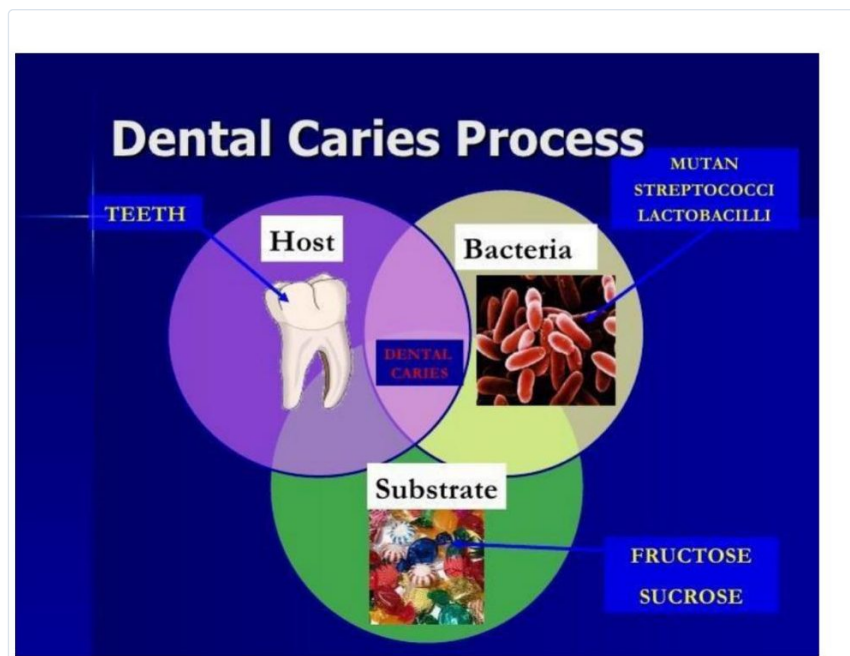


Fig. 1 — Caries process triad: host (teeth) · bacteria (mutans streptococci, lactobacilli) · substrate (fructose, sucrose). Time is the fourth, unpictured factor.

★ EXAM PEARL

The Venn diagram is a three-circle picture but the lecture's control list has **four** items — time is the one candidates forget. Any "which of the following is NOT required for caries" stem is testing this set.

§2 Types of caries and diagnosis

2.1 Classification

- **By tissue:** enamel caries · dentin caries
- **By site:** smooth surface · pits and fissures · occlusal · approximal · root caries
- **By behaviour/history:** occult (hidden) · arrested · recurrent · secondary · rampant · early childhood caries (ECC)

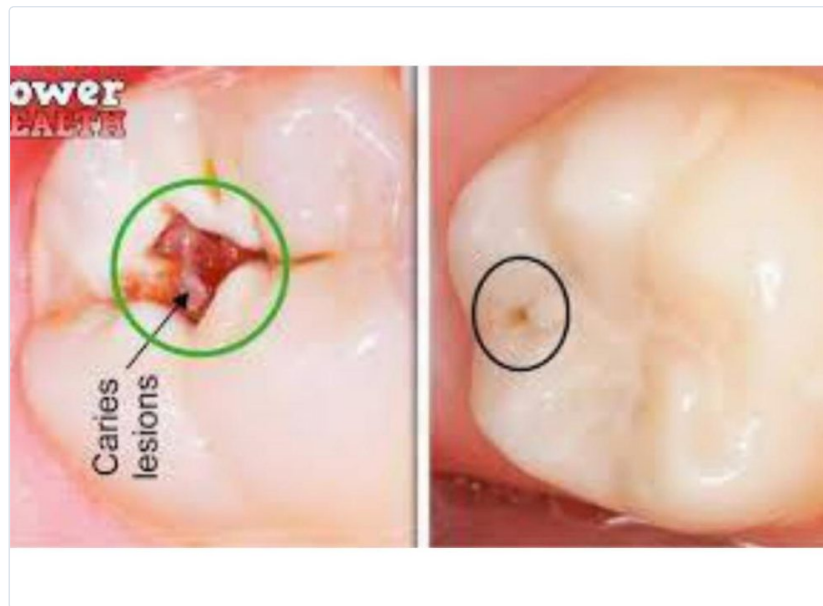


Fig. 2 — Left: frank cavitated carious lesion. Right: early/occult occlusal lesion — minimal surface change over undermined dentine.

2.2 Diagnosis

- **Vision:** good eyesight + magnification (loupes)
- **Probing:** blunt probe, horizontal dredging (dragging) motion — not sharp-point probing into fissures
- **Radiographs:** not every carious lesion appears on X-ray
 - ★ **40–50% demineralisation** required before a lesion is radiographically detectable
 - actual depth of penetration is **deeper** than the radiograph suggests
 - best view for caries = ★ **bitewing**
- **Adjuncts:** fiberoptic transillumination · laser-based (DIAGNOdent) · dyes (stain carious dentine)

★ EXAM PEARL

Two exam favourites sit on one slide: **bitewing** = best radiograph for caries, and radiographs **under-read** lesion depth. Treat the radiographic image as the minimum extent, never the true extent.

§3 Stages of prevention and risk assessment

Primary prevention

Ensure caries does **not** occur.

Secondary prevention

Treat starting incipient caries — **not yet cavitated**.

Tertiary prevention

Treat well-established lesions → restore function, avoid progression.

Table 1 — Identifying caries risk groups (clinical evidence)

	High risk	Low risk
New lesions	Present	None
Extractions	Premature extractions	No extraction for caries
Anterior teeth	Anterior caries / restorations	Sound anterior teeth
Restorations	Multiple / repeated	None or few
Sealants	No fissure sealants	Fissure sealed
Appliances	Multi-band orthodontics	No appliances

★ EXAM PEARL

Multi-band orthodontics alone puts a patient in the high-risk column — the single most-tested line of this table, and the reason ortho patients recur throughout the fluoride sections.

§4 Bacterial factor — plaque control

Table 2 — Organisms involved in dental caries

Organism	Morphology	Site	Role
<i>Streptococcus mutans</i>	Gram-positive cocci	Enamel	Metabolises sugar at low pH → key in caries initiation
<i>Lactobacillus</i> spp.	Gram-positive bacilli	Dentin	Survives at low pH → progression
<i>Actinomyces</i>	—	Root surface	Inactive except in xerostomia · most isolated in root caries

4.1 Physical plaque removal

- **By a professional:** effective only if **sufficiently frequent**
- **By the individual:** brushing ★ **twice daily**
 - do **not** brush right after meals → oral pH is low → brushing abrades softened enamel

4.2 Chemical plaque control

- **Rinsing after eating:** best immediate measure → buffers salivary pH · washes off acids · stops their action
- **Chlorhexidine:** antiseptic — **bactericidal and fungicidal**
 - unwanted effects: taste disturbance · staining

★ EXAM PEARL

Rinse after meals, brush **later** — the pairing examiners use to catch the reflex answer "brush immediately after eating". *S. mutans* = initiation (enamel); *Lactobacilli* = progression (dentin); *Actinomyces* = root caries.

§5 Substrate factor — sugars and diet

KEY POINTS

Diet is the single most important factor in caries prevention. Oral hygiene is most important for controlling **periodontal** disease — poor OH is only a **secondary** factor in caries, providing a good environment for it.

Table 3 — Sugar chemistry and cariogenicity

Class	Members	Note
Monosaccharides	Glucose · fructose (fruits) · galactose · mannose	—
Disaccharides	Lactose (milk) · maltose · sucrose (cane sugar)	—
Polysaccharides	Starch	Not readily broken down by oral flora
Extrinsic — milky	Milk-containing products, mainly lactose	Less cariogenic
Extrinsic — non-milky	Soft drinks, biscuits, cakes: sucrose, fructose, glucose	★ Highest cariogenicity
Intrinsic	Enclosed within a cell — whole fruit and vegetables	Less cariogenic

5.1 Dietary analysis

- **Duration:** consecutive ★3 or 4 days, including at least one weekend day
- **Patient records:** time · content · quantity of all food and drinks consumed
- **Also check:** toothbrushing times and bed time

Table 4 — Diet analysis sheet (structure as given in the lecture)

	Sat (time / item)	Sun	Mon	Tues
Before breakfast				
Breakfast				
Morning				
Mid-day meal				
Afternoon				
Evening meal				
Evening and night				

5.2 Dietary advice

- **Frequency first:** explain the effect of **between-meal eating** and sugary drinks
- **Confine sweets:** save sweets to be eaten in one day rather than spread out
- **All-in-one > packets:** one large chocolate bar preferred over packs of individual sweets → fewer acid challenges
- **Whole fruit > juice:** intrinsic sugar stays cell-bound
- **Artificial sugars:** avoid in **pre-school children**

★ EXAM PEARL

"Most important factor in caries prevention?" → **diet**. "Most important in periodontal disease?" → **oral hygiene**. Same slide, two answers — the classic paired stem.

§6 Tooth factor 1 — fluoride

6.1 Mechanism

- **Chemistry:** fluoride binds Ca and phosphorus ions of enamel → **hydroxyapatite** → **fluorapatite** → ↓ mineral solubility
- **Two routes:** systemic = **pre-eruptive** · topical = **post-eruptive** ★systemic = **pre-eruptive**
- **Reference:** Oxford Handbook of Clinical Dentistry p.28

6.2 Systemic fluoride

- **Water fluoridation:** ★1 ppm reduces caries incidence · most effective for **smooth surface** caries
- **UK coverage:** only 10% of the population receive fluoridated water
- **Other vehicles:** fluoridated milk 2.5–7 ppm · fluoridated salt
- **Supplements (ADA position):** limit to **high-risk** patients until eruption of the last tooth or until **age 16**, and to individuals on **non-fluoridated** water
- **Side effects:** range from white spots → dental fluorosis

Table 5 — Dietary fluoride supplement schedule (ADA / AAPD / AAP)

Age of child	Water < 0.3 ppm	Water 0.3–0.6 ppm	Water > 0.6 ppm
Birth – 6 months	No supplements	No supplements	No supplements
6 months – 3 years	0.25 mg/day	No supplements	No supplements
3 – 6 years	0.50 mg/day	0.25 mg/day	No supplements
6 – 16 years	1.0 mg/day	0.50 mg/day	No supplements

6.3 Topical fluoride — indications

- **Who:** patients at high and low caries risk (2–4 applications) · maximum ★4 times annually

- **Especially good for:** orthodontic patients · xerostomia · patients with special needs

6.4 Fluoride varnish

Table 6 — Varnish agents and their fluoride content

Agent	Concentration	Fluoride ion
NaF varnish (Duraphat)	5% NaF	2.26% F ⁻
Difluorosilane	1% silicon fluoride	0.1% F ⁻
SDF (silver diamine fluoride)	38% SDF	5% F ⁻

- **Advantages:** tolerable · no risk of swallowing · remains in contact with the tooth
- **Substantivity:** increased → continuous release of fluoride
- **Operator:** dentist or hygienist
- **Indicated in:** all children and young adults, especially those with special needs
- **Frequency:** twice yearly if low caries risk → up to ★4×/year (every 3 months) if high risk

CAUTION

Varnish contraindications: history of allergy to the constituents · ulcerative gingivitis · ANUG · stomatitis.

Aftercare: no brushing for 30 minutes after the session · no hard foods.

- **Naming clash:** DBOH guideline writes varnish as 2.2% NaF · lecture writes Duraphat as 5% NaF = 2.26% F⁻ → same product, guideline quoting the fluoride-ion figure loosely · both = 22,600 ppm F

6.5 Fluoride gels and foams

- **Use:** mainly Canada and USA · gel 1.23% fluoride (APF)
- **Drawbacks:** needs a special tray → extra cost · risk of swallowing and toxicity · low fluoride concentration (vs varnish)

6.6 Fluoride mouthwash

- **Role:** adjunct to fluoride toothpaste in high caries risk groups
- **Regimen:** daily use preferred, ★0.05% NaF = 0.023% F⁻ · use at a different time from brushing
- **Age limit:** not recommended under 8 years

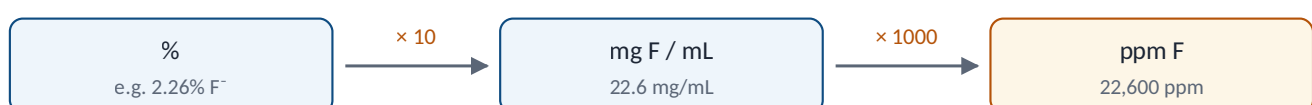
★ EXAM PEARL

Varnish beats gel on every axis the lecture lists — higher concentration, no tray, negligible swallowing risk, sustained release. If a stem asks for the topical agent of choice in a small child, it is **varnish**.

6.7 Fluoride concentrations and conversions

Table 7 — Fluoride concentration in various products

Product	As stated	mg F/mL	ppm F
Standard toothpaste	—	1 mg/mL	1,000 ppm
Standard toothpaste (higher)	—	1.5 mg/mL	1,500 ppm
Daily mouthrinse	0.05% NaF = 0.023% F	0.23 mg/mL	230 ppm
APF gel	1.23% F	12.3 mg/mL	12,300 ppm
Fluoride varnish (5% NaF)	2.26% F ⁻	22.6 mg/mL	★22,600 ppm



reverse: ÷ 1000 (ppm → mg/mL) · ÷ 10 (mg/mL → %)

shortcut: % × 10,000 = ppm

Diagram 2 — Fluoride unit conversion ladder, as worked in the lecture: % → mg/mL → ppm.

6.8 Fluoride toxicity

Table 8 — Toxic doses and acute management

Dose (mg/kg body weight)	Label	Features and management
1 mg/kg	Safely tolerated dose (STD)	—
5 mg/kg	Potentially lethal dose (PLD)	—
32–64 mg/kg	Certainly lethal dose (CLD)	—
< 5 mg/kg	Mild	Nausea, abdominal pain → give milk or calcium-containing products; observe at home
5–15 mg/kg	Moderate	Risk of systemic toxicity, more severe symptoms → immediate medical attention; induce vomiting if advised; calcium/milk; monitor
> 15 mg/kg	Severe	Life-threatening → emergency treatment and hospitalisation asap; cardiac monitoring; IV calcium; airway support

CAUTION

Fluoride binds calcium — hence **milk / calcium is the antidote at every severity**, oral at home for mild, IV for severe. Fatal outcome is cardiac (hypocalcaemia, arrhythmia), so severe cases get cardiac monitoring, not just gastric decontamination.

§7 Tooth factor 2 — fissure sealants

- **Why:** ★90% of caries occurs in pits and fissures
- **Material of choice:** light-cured **flowable composite**
- **Equivalent:** low-viscosity glass ionomer and resin-based sealers give the **same caries prevention effect**

7.1 Patient selection — children at high risk

- **Extensive ECC:** established early childhood caries
- **Low social level**
- **Early caries in first permanent molars**
- **Medically compromised**
- **Mentally and physically disabled**

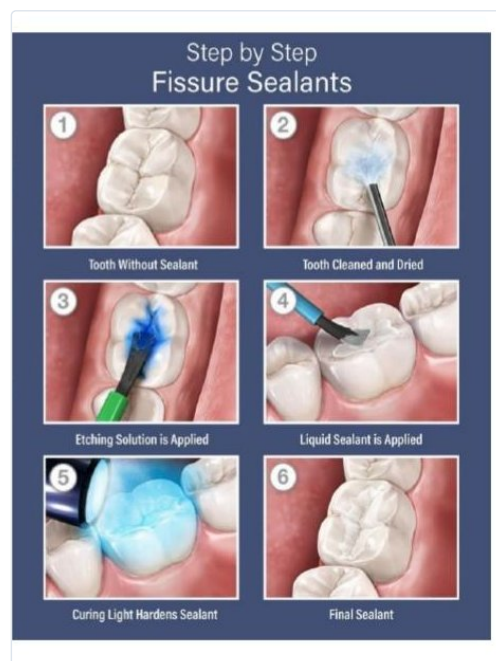


Fig. 3 — Fissure sealant technique: 1 unsealed tooth → 2 clean and dry → 3 etch → 4 apply liquid sealant → 5 light cure → 6 final sealant.

★ EXAM PEARL

Sealants and fluoride divide the work by site: **fluoride is best on smooth surfaces** (water fluoridation, §6), **sealants cover pits and fissures** — where 90% of caries actually happens. A stem contrasting the two is asking about site, not potency.

§8 Prevention guideline by age group (DBOH toolkit)

The lecture directs to *Delivering better oral health: an evidence-based toolkit for prevention*. Evidence-base grades omitted here as requested.

Table 9 — Prevention by age group: advice and professional intervention

Group	Advice to be given	Professional intervention
Children up to 3 years	Breastfeeding provides the best nutrition · from 6 months introduce a free-flow cup, from 1 year discourage bottle feeding · no sugar added to weaning foods or drinks · parent/carer brushes or supervises · brush twice daily with fluoridated toothpaste as soon as teeth erupt · last thing at night and on one other occasion · toothpaste no less than 1,000 ppm F · smear only · reduce frequency and amount of sugary food and drinks · sugar-free medicines	None specified
All children 3–6 years	Brush at least twice daily with fluoridated toothpaste · last thing at night and at least one other occasion · supervised by a parent/carer · toothpaste more than 1,000 ppm F · pea size · spit out, do not rinse · reduce sugary food and drinks · sugar-free medicines	Fluoride varnish 2× a year (2.2% NaF ⁻)
Children 0–6 giving concern likely to develop caries · special needs	All the above plus: toothpaste 1,350–1,500 ppm F · smear or pea size · if medication is frequent or long term, request it be sugar free or used to minimise cariogenic effects	Varnish 2 or more times a year (2.2% NaF ⁻) · reduce recall interval · investigate diet, assist good dietary practice per the Eatwell Guide · liaise with medical practitioner re sugar-free / minimally cariogenic medication
All patients 7 years+ and young adults	Brush at least twice daily with fluoridated toothpaste · last thing at night and at least one other occasion · toothpaste 1,350–1,500 ppm F · spit out, do not rinse · reduce sugary food and drinks	Fluoride varnish 2× a year (2.2% NaF ⁻)
7 years+ giving concern active caries · ortho appliances · dry mouth · other predisposing factors · special needs	All the above plus: daily fluoride mouth rinse 0.05% NaF at a different time to brushing	Fissure seal permanent molars with resin sealant · varnish 2 or more times a year · ★ 8 years+ active caries → daily fluoride rinse · ★ 10+ years active caries → 2,800 ppm paste · ★ 16+ years active disease → 2,800 or 5,000 ppm paste · investigate diet, Eatwell Guide
All adult patients	Brush at least twice daily with fluoridated toothpaste · last thing at night and at least one other occasion · toothpaste at least 1,350 ppm F · spit out, do not rinse · reduce sugary food and drinks	None specified
Adults giving concern active caries · dry mouth · other predisposing factors · special needs	All the above plus: daily fluoride mouthrinse 0.05% NaF at a different time to brushing	Varnish twice yearly (2.2% NaF) · active coronal or root caries → daily fluoride rinse · obvious active coronal or root caries → 2,800 or 5,000 ppm paste · investigate diet, Eatwell Guide

★ EXAM PEARL

The three age gates are the whole guideline in one line: **8 → rinse, 10 → 2,800 ppm, 16 → 2,800 or 5,000 ppm**. Toothpaste strength gates on age as well: smear <3, pea 3–6, 1,350–1,500 ppm from 7 (or from birth if giving concern).