HY-12 Teeth: preventing decay and gum disease with chew sticks, salt, diet and cleaning

HEALING after the FALL, research library, HY-12

Researched 10 October 2026 by Claude Opus agent for THRIVING after the FALL, Book Four. Library document, unverified.

A note on units. DMFT counts decayed, missing and filled teeth per person, DMFS counts surfaces, five to a tooth. Others report the percentage of people with caries, the percentage of teeth attacked, or new lesions per person per year. These are not interchangeable, and confusing them is the commonest error in the popular literature. Every figure below carries its unit. [VERIFY] marks a claim I could not check in a source I read, or a figure that is my own inference.

1. Findings by section

1.1 The mechanism

Decay is mineral dissolving in acid faster than it is replaced. Bacteria in the film on the tooth ferment dietary carbohydrate into organic acids. Below a plaque pH of about 5.5 enamel loses mineral, above it saliva puts it back. This is the Stephan curve.

Timing matters more than total acid. Plaque pH falls below 5.5 within 2 to 5 minutes of a sugar challenge, bottoms at 5 to 20 minutes and recovers over 30 to 60 minutes (dentalcare.com CE713). A glucose rinse study gives 30 to 120 minutes, and the brief's 20 to 40 minutes does not match the sources I read. Three consequences are the whole of prevention. Sugar six times a day keeps the tooth below critical pH for hours, the same total eaten once does not. Plaque thinner than about 0.5 mm develops only shallow curves. Chewing fibrous food raises saliva flow. Exposed roots demineralise at roughly pH 6.0 to 6.7 [VERIFY, revision guide, not a primary source], so old people with receding gums lose root at exposures that would not touch a child's enamel.

Gum disease is a different illness with a shared cause: the same film at the gum margin provokes inflammation. Gingivitis is reversible bleeding, periodontitis irreversible destruction of attachment and bone, acute necrotising ulcerative gingivitis a sudden foul destruction of the gum tips, and noma that process escaping the mouth in a starving child.

1.2 Sugar: the Vipeholm study

From 1945 to 1949 the Swedish Medical Board ran a feeding experiment on residents of Vipeholm Hospital in Lund, an institution for people with intellectual disability. Gustafsson and others (1954) report on 436 individuals over five years, in nine convenience groups given different amounts, frequencies and physical forms of sugar.

A group taking **30 g of sucrose a day, all at meals, averaged 0.27 new carious surfaces per person per year.** The toffee group took **24 sticky toffees a day, about 300 g of sugar, roughly 40 per cent of it between meals,**

and averaged 4.02 new lesions per person per year [VERIFY against the original paper, which I could not open. The figures come from search summaries and encyclopaedia accounts].

That is roughly fifteenfold. The finding is not that sugar causes decay, but that the *same sugar*, eaten sticky and between meals rather than in solution at meals, causes about an order of magnitude more. For a village with no dentist this is the most useful experimental result in preventive dentistry, because it is a rule about behaviour rather than supplies.

The caveats belong in the book. The subjects could not consent, Bo Krasse of the team later wrote that no ethics committee would accept the project today, by 1949 about fifty residents had teeth described as completely damaged, and the confectionery industry supplied money and sweets. The groups were not randomised, so the figures should not be taken literally, though the contrast between groups is hard to challenge. The Swedish response was *lördagsgodis*, Saturday sweets.

1.3 Sugar: the ecological record

Tristan da Cunha is the cleanest natural experiment, because the sugar arrived with a fish cannery on a known date. Sheiham and James (2014) give sugar at 1.8 g a head a day in 1938, 0.4 per cent of energy, with caries in 13 to 19 year olds at 2 per cent in 1937. By 1966 sugar was 150 g a day, 30 per cent of energy, caries in that age group 17.5 per cent, and in 40 to 49 year olds prevalence had risen from 11 to 32 per cent.

Japan is the only national dataset where sugar collapsed and recovered. In Takeuchi's series, reanalysed by Sheiham and James, sugar fell from about 15 kg a head a year to **0.2 kg in 1946**, then rose above 25 kg. The lowest caries prevalence recorded, 25 per cent of 6 to 11 year olds, fell in 1949 to 1951 when sugar was under 15 kg. At 30 kg a year, 70 per cent of 14 to 16 year olds had caries. **Molar caries doubled between roughly 0 and 5 kg a year**, about 2.7 per cent of energy. The curve has no flat bottom.

Hopewood House, Bowral, New South Wales, from 1942, kept children on a largely raw vegetarian diet, sugar and refined flour nearly absent. Sullivan and Goldsworthy (1958) and Harris (1963) reported much lower caries than local state-school children **despite poor oral hygiene**, converging on local rates once children left at about twelve. A circulating figure of 46 per cent caries-free against 1 per cent comes from revision flashcards and should not be printed [VERIFY].

1.4 Sugar: the systematic reviews

Moynihan and Kelly (2014), for WHO, screened 5,990 papers and found 55 eligible, with **no randomised trials at all**. Of child studies 42 of 50 reported at least one positive association, as did 5 of 5 in adults. Under GRADE: **moderate-quality evidence that caries is lower when free sugars are under 10 per cent of energy, and a significant relationship under 5 per cent but on very low quality evidence.** WHO (2015) made 10 per cent a strong recommendation and under 5 per cent, about 25 g a day for an adult, a conditional one.

Sheiham and James (2014, 2015) argue both are too generous. They find the relationship **log-linear, not sigmoid, with no evident threshold**, and recommend **2 to 3 per cent of energy throughout life, whether or not fluoride intake is optimal**. Supporting correlations: Buttner, 18 countries, r = 0.95 between sucrose and DMFT in 10 to 12 year olds, and Szpunar, each extra 5 g a day predicting a 1 per cent rise in caries over three years.

There is no safe amount of free sugar, only a dose and a frequency, both of which can be pushed down. At 2 to 3 per cent of energy, caries becomes a slow disease of old age rather than a fast one of childhood.

1.5 The archaeological and anthropological record

The simple story is that caries rose with grain, and it is partly wrong. A 2019 Current Anthropology metastudy of **185 sites** found caries prevalence differing significantly between agricultural and hunter-gatherer populations, but

the distributions overlapped by more than 70 per cent, and **tooth loss and abscesses showed no significant difference**. In the Levant caries rose only from **6.4 per cent of teeth in Natufian hunter-gatherers to 6.7 per cent at the Neolithic onset**. Rice shows no consistent rise, and acorn-eating foragers had high rates (Crittenden and others 2017).

The **Hadza** study (Crittenden and others 2017) breaks the story deliberately. Of 75 adults, 36 per cent had a visible carious lesion, 24 per cent of women and 49 per cent of men. **Bush men had more caries than village men** ($p = 0.001$) while **bush women had less than village women** ($p = 0.042$). Bush diet by energy: wild plants 46 to 53 per cent, **honey and larvae 11 to 15 per cent**, meat 32 to 35 per cent. The authors attribute the women's pattern to maize and the men's to liquid honey. And **80 per cent had current periodontitis**, 66 per cent past. Honey is cariogenic, maize is cariogenic, and foraging does not prevent gum disease.

1.6 Weston Price, read as data

Price, a Cleveland dentist, travelled in the 1930s and published *Nutrition and Physical Degeneration* in 1939. He examined a population on a traditional diet, then a nearby group of the same people on trade food, counting carious teeth per 100 teeth examined.

Children's group	Place	Caries per 100 teeth
Traditional	Isolated high Swiss valleys	3.4 of 4,280 teeth
Modern	Vissoie, Anniviers	20.2
Modernised hamlet	Tarbert, Harris	32.4
Primitive foods	Airth of Sleat, Skye	0.7
Modern foods	Airth of Sleat, same hamlet	16.3

He also records that 25 of 100 Stornoway adults aged 20 to 40 wore artificial teeth.

What is strong is the within-village comparison. Vissoie at 20.2 against 3.4 in the isolated valleys, and 0.7 against 16.3 in the *same hamlet* on Skye, are contrasts confounding struggles to produce, and they agree with Vipeholm, Tristan and Japan. **What is weak**: no sample sizes for most groups, no dates, no quantified diets, and an unblinded examiner who was also author of the hypothesis. Jarvis's *Nutrition Today* review classes the work as the myth of the healthy savage, faulting a preconceived view and the neglect of periodontal disease [VERIFY, secondary accounts only], which the Hadza data vindicate. Price also advocated focal infection theory, which was wrong and caused needless extraction. Use him as a counter of teeth within villages, not a source for what to eat.

1.7 Chew sticks and miswak

A chewing stick is a twig with one end chewed until the fibres separate, attested across Africa, Arabia and South Asia, and in several traditions a religious obligation, which is why compliance is good. The headline species is ***Salvadora persica*** L., the arak tree, root and stem, whose reported constituents include benzyl isothiocyanate, bactericidal against Gram-negative bacteria, tannins said to inhibit glucosyltransferase, and fluoride (Alharbi and others 2025).

A 2022 meta-analysis (Mohd Said and Mohd Dom) pooled nine trials of miswak against a toothbrush: **plaque SMD 0.39, CI minus 0.05 to 0.83. Gingivitis SMD 0.13, CI minus 0.16 to 0.43.** Both cross zero, so the reading is comparable, not superior.

A 2025 systematic review found **10 randomised trials, 442 adults**, too heterogeneous to pool, sizes 15 to 80, and **only one assessing caries**. Two results matter. Sofrata 2011 ($n = 68$) found **fresh miswak did not outperform inactivated miswak**, and Zarabadipour 2020 ($n = 80$) found **no difference between active and inactive siwak**. If the chemistry mattered much, those two should have detected it.

Darout, Albandar and Skaug (2000) examined **213 Sudanese men**, 109 miswak users and 104 toothbrush users. Miswak users had less calculus and fewer posterior sextants with 4 mm probing depth, but **more attachment loss of 4 mm or more**. The authors concluded miswak was better. The attachment-loss result cuts the other way and must be quoted beside it.

Secondary sources agree WHO endorsed the miswak in the mid-1980s, most saying 1986 and some 1987, but **I could not find the original WHO document**, and a 2000 consensus report in the International Dental Journal concluded more research was needed. A chewed stick, used properly, removes plaque about as well as a brush, and that is enough. Claims that its chemistry does the work are not supported by the two trials that tested exactly that.

1.8 Brushes from twigs, cloth and bristle

Hesperian's *Where There Is No Dentist* gives the most field-tested instructions available, and they are startlingly undemanding. It holds that cleaning carefully once a day beats cleaning poorly many times.

- A homemade brush: a soft green branch of young bamboo, strong grass, or the skin of sugar cane or betel nut. Chew one end stringy and sharpen the other to clean between teeth. Coconut husk fibre twists into a brush, shaken out first.
- Stiff bristles hurt the gums. Soften a hard brush by soaking the bristles, not the handle, in hot water. Some chewing-stick wood is very hard and damages gums, and neem is named as a soft wood that works. A cloth round a small stick cleans one tooth at a time.
- Shorten an adult brush for a child by pulling out back bristles, never cutting them, because the rounded tops are gentler.

The technique taught is a simple scrub of tops and sides, especially the grooves, then pushing the bristles between the teeth. Not what a hygienist teaches, and deliberately so: a method people will keep doing.

1.9 Dentifrices: salt, bicarbonate, charcoal, or nothing

Hesperian is blunt: "Charcoal or even just water is enough."

Nothing. A systematic review of brushing with and without a dentifrice found **no significant difference** in plaque removal, moderate certainty, studies averaging 44 participants (Valkenburg and others, ACTA).

Bicarbonate. Valkenburg and others (2019), 21 publications and 43 comparisons, found baking soda dentifrices gave lower plaque scores than both negative and positive controls after a single brushing, pooled differences about **minus 0.20 and minus 0.18**, and **minus 0.19** against negative control on follow-up. A 2017 JADA review calls bicarbonate antibacterial and **low in abrasivity**, RDA for 35 to 45 per cent pastes 57 to 134. **I found no source for the widely circulated RDA of 7.**

Salt. No trial tests dry salt as a dentifrice against anything. It is traditional worldwide and at worst neutral. As a rinse there is more. A systematic review of seven saline-rinse trials reported reductions in plaque, bleeding and probing depth in most, judging saline slightly weaker than chlorhexidine [VERIFY, publication details not confirmed]. After extraction, a randomised trial of **120 patients** comparing six warm saline gargles a day, two a day and none found **both regimens reduced alveolar osteitis against no rinsing, with no difference between six and two**. A review of eight trials found saltwater better than no mouthwash and worse than chlorhexidine, mechanism unexplained.

Charcoal. Brooks, Bashirelahi and Reynolds (2017) screened 118 articles and found **insufficient clinical and laboratory data to substantiate safety or efficacy claims**. Charcoal is abrasive to teeth and gingiva, and dentine abrasivity results were given for only one product reviewed. A 2023 study reported RDA of 24 to 166 across 12 charcoal products [VERIFY, secondary report], and sources disagree on the harmful threshold. In a village the whole safety question is particle size: fine, well-sieved wood charcoal is probably no worse than most commercial pastes, and gritty charcoal is a lapping compound.

1.10 Does cleaning without fluoride prevent decay at all?

This is the most uncomfortable result in the file and the book must print it. **Hujoel, Hujoel and Kotsakis (2018)** pooled three randomised studies, **743 participants**, of personal oral hygiene without fluoride. Pooled effect on DMFS: **minus 0.11, 95 per cent CI minus 0.91 to 0.69**. Their conclusion is that personal oral hygiene in the absence of fluorides has failed to show a caries benefit, and the brushing in those trials was meticulous. Against it, Marinho and others (2003) pooled 70 studies and 42,300 children and found fluoride toothpaste giving a **DMFS prevented fraction of 24 per cent, 95 per cent CI 21 to 28**, and Walsh and others found the effect significant only at **1000 ppm and above**.

This does not mean brushing is useless. It removes plaque, and plaque drives gum disease, where the evidence is separate and strong. It means that **without fluoride the caries benefit of brushing is unproven and the point estimate is zero. For cavities diet carries almost the whole weight, for gums cleaning does.** A village that brushes diligently and eats honey all day will still lose teeth to decay. A village that cuts sugar hard and cleans carelessly will keep its crowns and lose its gums.

1.11 Oil pulling

Tradition, chiefly Ayurvedic, holds that swishing sesame or coconut oil draws out disease. Jong and others (2023) pooled randomised trials against mouthwashes: probable benefit for gingival health, chlorhexidine superior for plaque, **GRADE certainty very low**, samples 20 to 90, all but one trial at high risk of bias. Kuroyama and others (2015) report **two cases of exogenous lipoid pneumonia** in habitual sesame oil pullers. Oil pulling costs edible fat and buys very little, so it is not in the protocols.

1.12 Fluoride: sources, and what the Fall changes

The record. Dean's 21 Cities study (1942) examined about 7,000 children aged 12 to 14 and found caries falling as water fluoride rose, **plateauing above 1.0 ppm**, with fluorosis at 1.0 ppm low and mostly very mild. The Grand Rapids trial began **25 January 1945** with Muskegon as control, and over 13 to 15 years **caries fell 50 to 70 per cent** among children in fluoridated communities (CDC timeline). **The adult effect is far smaller:** Australian cohorts with over 75 per cent lifetime fluoridation against under 25 per cent had **11 and 10 per cent fewer DMFT**, and Irish DMFT in 35 to 44 year olds was 16.0 against 13.3. Fluoride modifies the sugar relationship and does not abolish it.

Groundwater is a lottery. A 2019 review of 11 Ethiopian Rift Valley studies pooled **mean groundwater fluoride at 6.03 mg/L, CI 4.72 to 7.72**, and **dental fluorosis at 28 per cent, CI 24 to 32**, with up to 8 million people in the Main Ethiopian Rift exposed. In Tanzania's Hai District, 152 wells averaged 1.6 mg/L with **12.5 per cent above the WHO guideline of 1.5 mg/L**. A village's water may be too low, about right, or poisonous, and looking will not tell you.

Tea. Fung and others (1999) measured brewed **brick tea at 7.34 mg/L, black tea 1.89, green tea 1.60**, with 83.6 per cent of leaf fluoride released in 5 to 15 minutes of brewing. In Tibet, where brick tea is a staple, a survey found **dental fluorosis in 33.57 per cent of children and skeletal fluorosis in 46.06 per cent of adults**. The window between useful and crippling is narrow.

What the Fall changes. Fluoride toothpaste ends with the last factory and fluoridated water with the dosing plant. What remains is what the local rock puts in the water, and salt fluoridation needs an industrial source and dosing control. **A village cannot safely add fluoride, though where water is naturally high it can remove some.** A 1997 Tanzanian field test found a **20 L bucket with 10 kg of bone char reduced fluoride from 10.5 mg/L to under 1 mg/L for 4 to 13 months**, and over 1,000 household filters were installed in Kenya and Tanzania by about 2011. The fluoride chapter of the Fall is mostly subtraction.

1.13 Gum disease, ANUG and noma

Scale. GBD 2019 counted about **2.03 billion prevalent cases of untreated caries in permanent teeth**, up 46.07 per cent since 1990 on population growth, and severe periodontitis in about **1.1 billion, up 99.0 per cent**, with GBD 2021 putting age-standardised prevalence at 12.50 per cent.

ANUG, trench mouth. Sudden onset, punched-out necrotic gum tips, grey slough, severe pain, bleeding on the lightest touch, foul breath, often fever and tender nodes. Plaut and Vincent described it in the 1890s and the wartime name comes from front-line troops, with stress, smoking and poor hygiene implicated. Treatment, per the Merck and MSD professional manuals: **gentle debridement with a hand scaler, spread over several days**, plus improved hygiene, rinses and supportive care, with **marked improvement usually within 24 to 48 hours**. Antibiotics are for when debridement must wait: **metronidazole 500 mg or amoxicillin 500 mg every 8 hours** (THRIVING library, IN-05, lists metronidazole as the WHO Access drug for dental abscess and anaerobes). A 1975 South African regimen used warm irrigation and hydrogen peroxide and noted chlorhexidine and povidone iodine mouthwashes were **ineffective in the acute phase without debridement**. The rinse does not replace the scraping.

Noma, cancrum oris. WHO staging: warning sign, simple gingivitis. Stage 1, acute necrotising gingivitis. Stage 2, oedema. Stage 3, gangrene. Stage 4, scarring. Stage 5, sequelae. **The early stages are reversible.** Case fatality is quoted at **90 per cent untreated** throughout the literature, and **I could not trace that figure to an original study**. Death comes from starvation, aspiration pneumonia or sepsis. In northern Nigeria 1999 to 2024, average and median annual incidence were **3.4 and 1.6 per 100,000**, and WHO's estimate of 140,000 new cases a year dates from 1998. Risk factors from a prospective cohort: severe malnutrition, recent respiratory or diarrhoeal illness, altered oral microbiota, and **the absence of chickens at home**. Measles is a precursor, and most African cases fall in the dry season. Noma is the visible end of a process that starts as gingivitis in a hungry child, so looking into children's mouths in a hungry season is the intervention.

1.14 Gum disease and systemic illness

Association, not demonstrated causation. The 2020 EFP and World Heart Federation workshop report (Sanz and others), whose full text I could not retrieve, describes independent associations with cardiovascular disease, diabetes, COPD and sleep apnoea, and meta-analysed cardiovascular risk estimates are generally under 2. For diabetes, a 2013 meta-analysis of 15 trials found HbA1c falling **0.38 per cent** at 3 to 4 months and not significantly at 6, and a 2015 meta-analysis of 9 trials found **0.27 per cent**. For preterm birth, an observational meta-analysis of **37 studies** gives **OR 2.20, CI 1.80 to 2.69**, while 13 treatment trials gave **RR 0.90, CI 0.68 to 1.19**. Smoking, diabetes and poverty confound all of it. Clean teeth because teeth matter, not to save a heart.

1.15 Children's teeth

The incisors most at risk of early childhood caries erupt from **6 months**, complete by 12, with first molars at **13 to 19 months**, so a night-fed infant in the second year is bathing teeth that have just arrived.

Tham and colleagues pooled 63 papers: breastfeeding **up to 12 months, OR 0.50** for caries, **beyond 12 months against under 12, OR 1.99**, and within that group **nocturnal or frequent feeding, OR 7.14** across five studies. Avila and others (2015) found breastfeeding more protective than bottle feeding, with several included studies failing to adjust for confounders. For the book: breastfeed, and breastfeed past a year if that is what keeps a child alive, which after the Fall it often will be, knowing that night feeding after the first year raises risk sharply. Hesperian is categorical that a child should never be given juice or sweet tea from a bottle.

Supervised brushing. Scotland's Childsmile nursery programme is the best population evidence. Linked data on **99,071 children 1987 to 2009** showed a strong association between uptake and falling caries, and a cohort of **50,379 children born 2009 to 2010** showed reduced odds with more years of exposure, **greatest in the most deprived areas**. Anopa and others (2015) put pre-programme treatment costs at about £8.8 million, falling by more

than half within ten years against an annual programme cost of about £1.8 million. These are observational, and the transferable finding is not the money: **collective, supervised, daily cleaning of small children's teeth by an adult works at population scale**, and a village can do it with sticks and water. Hesperian also gives one intervention I did not expect, painting **10 per cent povidone iodine** on baby teeth every three months. I found no trial of it [VERIFY].

1.16 Where There Is No Dentist

Murray Dickson's *Where There Is No Dentist* (Hesperian, 1983) is built for exactly the reader of HEALING, and its structure is its argument: **five chapters on teaching and prevention before one on diagnosis and five on treatment**. Babu and Eisenberg (2010) found *Where There Is No Doctor*'s prevention advice correct in 96 to 100 per cent of sections against diagnosis likely correct in 18.5 (THRIVING library, FO-06). **Prevention advice ages well.**

1.17 Plants, by binomial, part used and lookalikes

Plant	Binomial, family	Part	Evidence	Cautions and lookalikes
Arak, miswak	*Salvadora persica* L., Salvadoraceae	Root or stem twig, 5 to 8 mm	As good as a toothbrush	Arid Africa, Arabia, India. No toxic lookalike known to me
Neem	*Azadirachta indica* A. Juss., Meliaceae	Soft young twig	A soft wood that works (Hesperian)	**Neem oil and seed are toxic to infants and have killed children.** The twig is chewed and spat
Bitter kola	*Garcinia kola* Heckel, Clusiaceae	Stem wood, twigs	Biflavonoid GB1, MIC 32 to 64 µg/mL against *S. mutans*, in vitro	West African forest. Confusable with other *Garcinia*
West African satinwood	*Zanthoxylum zanthoxyloides* (Lam.), Rutaceae	Root and stem twigs	Berberine and chelerythrine, active in vitro at pH 7.5	Thorny. The genus has species with irritant oils
Bamboo	*Bambusa* spp., Poaceae	Green young branch	Hesperian's first homemade brush	Some shoots are cyanogenic. Chewed and spat, never eaten
Sugar cane	*Saccharum officinarum* L., Poaceae	Skin, as a brush	Hesperian	The brush is fine. The juice is the enemy
Betel nut palm	*Areca catechu* L., Arecaceae	Skin, as a brush	Hesperian	**The nut is a group 1 carcinogen causing oral cancer and submucous fibrosis.** Skin only. Hesperian omits this
Coconut	*Cocos nucifera* L., Arecaceae	Husk fibre, twisted	Hesperian	Shake out loose fibres or they lodge in the gum

Plant	Binomial, family	Part	Evidence	Cautions and lookalikes
Clove	*Syzygium aromaticum* (L.) Merr. and Perry, Myrtaceae	Dried flower bud	Analgesia equal to benzocaine in one trial (THRIVING library, WO-11)	**Clove oil is toxic swallowed.** A whole clove is the safe form
Tea	*Camellia sinensis* (L.) Kuntze, Theaceae	Leaf	A fluoride source, 0.78 to 6.03 mg/L in infusion	**Brick tea as a staple gave skeletal fluorosis in 46.06 per cent of Tibetan adults surveyed**

Other African species with in vitro antibacterial reports include *Vernonia amygdalina*, *Anogeissus leiocarpus*, *Terminalia glaucescens* and *Massularia acuminata*, some already endangered by harvesting.

1.18 Feasible today, feasible after

Lost with the factories: fluoride toothpaste and water, sealants, fillings, ultrasonic scaling, radiographs, silver diamine fluoride. Available immediately after: cutting free sugar, cutting frequency, a chewed stick or a cloth, salt water, supervised cleaning of children's teeth, looking in mouths. Available with effort: boar-bristle brushes set in bone, bone char fluoride removal, hand scaling with forged instruments, and peroxide and ethanol while they last. Available only at a district: salvaged metronidazole, extraction under local anaesthetic, and any restoration at all.

One salvageable technology is worth naming. **Silver diamine fluoride at 38 per cent**: Gao and others (2016) pooled eight studies in primary teeth and found **about 81 per cent of active lesions arrested, 95 per cent CI 68 to 89**, staining the lesion black but with no other significant complication. A shelf-stable bottle that arrests cavities in children without drilling is the highest-value dental item in a salvaged pharmacy, and it cannot be made.

2. Evidence grades

The third column separates claim from record.

Practice or claim	Grade	Record against claim
Free sugars under 10 per cent of energy	**A**	Moderate quality, 55 studies
Cutting the frequency of sticky sugar	**B**	0.27 against 4.02 lesions a year
Fluoride toothpaste, 1000 ppm or more	**A**	Prevented fraction 24 per cent, 70 studies
Water fluoridation at about 1 ppm	**A**	50 to 70 per cent less caries, children
Adult-supervised cleaning of children's teeth	**B**	Childsmile, 99,071 children
Oral hygiene for caries, no fluoride	**X-leaning**	Claimed preventive. Pooled DMFS minus 0.11
Miswak against a toothbrush	**B** equivalence	Claimed superior. Both SMDs cross zero. Fresh did not beat inactivated
Bicarbonate as a dentifrice	**B**	Plaque minus 0.20. Low abrasivity

Practice or claim	Grade	Record against claim
Warm salt rinses after extraction	**B**	Less alveolar osteitis. Twice equals six times
Oil pulling	**D**	Chlorhexidine better. Two lipoid pneumonias
Debridement for ANUG	**B**	Better in 24 to 48 hours
38 per cent silver diamine fluoride	**A**	81 per cent of lesions arrested
Price's within-village contrasts	**C**	0.7 against 16.3 per 100 teeth
"Foraging protects the mouth"	**X**	Hadza: 80 per cent periodontitis

3. Means ledger

Hands and knowledge alone. Chew a known-safe twig into fibres and scrub every tooth daily, or use a cloth on a finger. Stop eating sugar between meals. Look into every child's mouth weekly when food is short. *This is most of the achievable benefit, and it is free.*

At the hearth. Boiled salted water for the baby's gum cloth. Warm salt rinses twice daily after any extraction, mouth injury or bleeding gums. A clove against an aching tooth. *Adds wound care, and the rinse cuts the dry-socket rate.*

Garden and still. Coppice a chewing-stick stand. Forge a sickle and a straight hand scaler, about 15 cm, hardened. Burn and crush clean bones to char where water mottles teeth. Ethanol as rinse and instrument soak. *Adds scaling, the only treatment for established gum disease a village can give.*

Village dispensary, 300 people. A dated record for every person: teeth present, teeth lost, pockets, bleeding. Annual inspection of every child under 12 and every pregnant woman. Supervised daily cleaning of under-fives. Scaling every 6 to 12 months where there is calculus. A public rule on sweet things, tied to the FEASTING decisions on cane, bees and fruit. Salvaged silver diamine fluoride for children's cavities and metronidazole for ANUG and noma. Extraction where a tooth cannot be saved. *A yearly look finds ANUG at stage 1, not stage 3.*

District infirmary, 3,000 people. Fluoride measured in every water source [VERIFY, I did not establish which field test survives]. Central bone char defluoridation. Drainage of facial space infections, airway management, and noma care with antibiotics, debridement and feeding. Training and audit of village healers. *Water chemistry becomes adjustable and deep infection survivable.*

A hospital before the Fall. Varnish, sealants, radiographs, fillings, root canals and oral surgery. *The lost rung is everything downstream of the first cavity. Before the Fall a hole is a filling. After it, a hole grows, abscesses, and is pulled. Prevention must be absolute rather than good.*

4. Harm test

Diet advice. Telling a hungry village to cut carbohydrate kills people. The error that harms is reading "cut free sugars" as "cut calories". The rule is *shift the sugar, do not remove the energy*: fruits, nuts and oils give energy without harming teeth. **Never restrict** infants, children recovering from illness, pregnant or breastfeeding women, anyone losing weight, or anyone needing oral rehydration solution (THRIVING library, HY-08). Signs it is going wrong: children losing weight, breastfeeding stopped, food refused on dental grounds. Then rescind the rule publicly.

Chewing sticks. Hard wood lacerates the gum, splinters lodge in the sulcus and abscess, and hard scrubbing causes recession and, over years, abrasion notches at the neck of the tooth, which then decay at root-surface pH. **Misidentification is the serious risk.** Cardiac glycosides, cyanogenic glycosides and irritant terpenes are common in exactly the scrubby growth that looks like good stick material, so use one or two named species only. Betel nut is carcinogenic: use the skin, never the nut. Neem twig chewed and spat is traditional, while neem oil is toxic and has killed

infants. Signs it is going wrong: bleeding after a change of stick, a notch at the gum line, a sore on one side only. Then use cloth on a finger for two weeks and change species.

Abrasives. Abrasion is cumulative and irreversible: a wedge-shaped notch at the neck of the tooth that eventually reaches the nerve. Coarse charcoal, gritty ash and dry salt crystals do it, and Brooks and others (2017) found dentine abrasivity data for only one charcoal product reviewed. **If a powder grits between finger and thumb, it is too coarse.** Never on exposed roots, sensitive dentine, or children.

Salt rinses and oil pulling. Very hot water scalds and strong brine delays healing on an open socket. Household strength is a level teaspoon, 5 g, in about 250 mL of warm water [VERIFY, household recipe, not sourced to a trial]. Do not swallow it, least of all on a salt restriction for heart or kidney disease. Oil pulling causes lipoid pneumonia by aspiration, so never with a swallowing difficulty, a reduced conscious level, a cough, or in small children.

Fluoride, the genuinely dangerous substance here. *In the growing tooth*: dental fluorosis, white flecks to brown staining and pitting, commonly put at about **0.1 mg per kg body weight per day**, though reported under 0.03, while EFSA and the UK COT use **0.05 mg/kg/day**, traceable to McClure in the 1940s and admittedly thin. *In bone*: skeletal fluorosis, with pain, stiffness and crippling deformity, at 46.06 per cent of adults in one Tibetan brick-tea survey. *Acute*: the **probably toxic dose is about 5 mg F per kg body weight**, with symptoms possible at 3 to 5 mg/kg, and **under two ounces of ordinary toothpaste at 900 to 1,100 mg/kg reaches it in a 10 kg child.** Lethal estimates vary by an order of magnitude: 32 to 64 mg/kg in adults, 500 mg in a small child, deaths reported from 16 mg/kg. Signs are nausea, vomiting, abdominal pain and salivation, then tremor, convulsions and arrhythmia from low calcium. Give calcium by mouth, milk or chalk in water, and do not induce vomiting in a drowsy child. There is no village treatment for a serious dose. **Never try to add fluoride to anything**, and treat any salvaged fluoride product as a poison for one named person to lock away.

Scaling. An untrained hand lacerates gum, gouges root and drives infection deeper, and the bacteraemia can seed endocarditis on a damaged valve. **Never scale** a known murmur or valve disease without antibiotic cover, or anyone with a bleeding disorder. Signs it is going wrong: bleeding not stopping in 10 minutes under pressure, fever within 48 hours, pain rising rather than falling.

Historical cases of harm. Vipeholm, 1945 to 1949: about fifty residents' teeth destroyed by an experiment they could not consent to. Brick tea in Tibet and Qinghai: a culturally central food crippling nearly half the adults surveyed. Sesame oil pulling in Japan: two documented lipoid pneumonias.

5. Red flags

1. **Swelling of the floor of the mouth, tongue pushed up, difficulty swallowing saliva, changed voice, unable to lie flat.** Ludwig's angina. Pre-antibiotic mortality is quoted at 10 to 40 per cent in one review and above 50 in others, against under 8 to 10 today. Print the disagreement. *Sit the patient upright, never flat, give any antibiotic covering anaerobes and streptococci, send for the district. If the airway closes a village can do nothing.*
2. **Facial swelling closing the eye, or spreading to the neck, with fever and rigors.** Spreading odontogenic infection. *Drain any swelling that points, extract the tooth if it can be reached, antibiotics if any, fluids, upright.*
3. **Trismus, unable to open the mouth two fingers.** Spreading infection or tetanus, separated by the spatula test (THRIVING library, WO-14).
4. **Grey, punched-out, bleeding gum margins with foul breath in a malnourished child.** Noma stage 1, the one red flag a village can still act on. *Feed the child. Clean the mouth gently with salt water several times a day. Metronidazole if any exists. Check for measles.*
5. **A hard swelling of the cheek with a dusky or black patch of skin over it.** Noma stage 2 or 3. *Feed by whatever route works, antibiotics if any, clean the wound, keep the child warm and hydrated, and tell the family the truth.*

6. **A mouth ulcer unhealed at three weeks, hard rolled edge, in a betel chewer, smoker or drinker.** Oral cancer. *Nothing curative. Stop the betel and tobacco for the rest of the household. Comfort, soft food, pain relief.*
7. **Many teeth loosening under 40 with little plaque.** Aggressive periodontitis or diabetes. *Scale, expect to lose them, prepare for a soft diet.*
8. **Any mouth infection with inability to drink for 24 hours or no urine for 12 hours** (THRIVING library, FO-06).

Honest comfort. When a tooth cannot be saved or pulled, and when a face is dying, the village has company, warm salt water, whatever analgesia exists, something soft to eat, and the truth told once, kindly, not repeated at every visit.

6. The case against

Against the chapter's premise. Hujoel's finding that oral hygiene without fluoride does nothing measurable for caries undercuts half of what this report recommends. The brushing there was supervised and the pooled DMFS was minus 0.11, straddling zero. If it holds, a village spending labour on chewing sticks is buying gum health, and should say so. *The counter:* gum disease is the leading cause of adult tooth loss, cleaning prevents it, and the trials were short, in children, with other fluoride exposure.

Against the sugar evidence. No randomised trial of sugar restriction and caries exists in 5,990 screened papers. Vipeholm was not randomised and its sponsors had an interest. Tristan and Japan conflate sugar with everything else that changes when a cannery opens or a war ends, and US Dietary Guidelines reviewers flagged unclear endpoints there. *The counter:* 42 of 50 child studies and 5 of 5 adult studies positive, four independent designs pointing one way. Without trials, convergence is the best evidence there is.

Against Price. Jarvis in *Nutrition Today* classes the work as the myth of the healthy savage, faulting it for no quantitative dietary analysis, a preconceived view of so-called primitive peoples, and overlooking periodontal disease [VERIFY, secondary knowledge]. The Hadza vindicate that last charge. *The counter:* a Skye hamlet at 0.7 per 100 teeth on traditional food and 16.3 on trade food is a fact about that hamlet, independent of his theory.

Against the miswak literature. Small trials, almost all from countries where the practice is religious, often testing commercial products rather than twigs, one of ten assessing caries, and the two that tested the chemistry found nothing. *The counter:* "just a brush" is all this book claims.

The romance of the hospital. Its counter-romance is that nothing can be done without a dentist. Childsmile, Vipeholm and the miswak trials say most of the population benefit of modern dentistry comes from things a village can do.

7. Ten-line summary

1. Caries is acid dissolving mineral. Below plaque pH 5.5 enamel dissolves, above it rebuilds, and sugar frequency sets the time below.
2. Vipeholm: 30 g of sugar a day at meals gave 0.27 new carious surfaces a year, 300 g with sticky sweets between meals gave 4.02.
3. WHO's under 10 per cent of energy rests on moderate evidence, under 5 per cent on very low. Sheiham and James argue for 2 to 3 per cent.
4. Tristan da Cunha went from 0.4 to 30 per cent of energy as sugar between 1938 and 1966, and caries in teenagers from 2 to 17.5 per cent.
5. Across 185 archaeological sites farmers had more caries than foragers, but the distributions overlapped by over 70 per cent, and Hadza bush men on honey beat village men.
6. A chewed stick is about as good as a toothbrush for plaque and gingivitis. The trials testing its chemistry found nothing.

7. Oral hygiene without fluoride showed a pooled caries effect of minus 0.11 DMFS, straddling zero. Clean for the gums, cut sugar for the cavities.
8. Toothpaste is not necessary. Water is enough, bicarbonate helps a little, charcoal is abrasive and unevidenced, salt is harmless.
9. Two warm salt rinses a day after an extraction reduce dry socket as much as six do.
10. Noma begins as gingivitis in a hungry child, is reversible then, and is quoted at 90 per cent fatal once past it.

8. Open questions

- **Does cleaning without fluoride prevent caries?** Hujoel's pooled zero rests on three short trials in children. Nobody has tested a lifetime of chewing-stick use in a low-sugar, no-fluoride adult population, the question the Fall asks.
- **What is the caries rate of a low-sugar population with no cleaning?** Hopewood House is the nearest thing, and the tables that would settle it were not reachable.
- **Does any chewing-stick species beat a plain twig?** No trial compares *Salvadora persica* against an inert stick of the same shape, and none has costed what a coppiced stand yields for 300 people.
- **What sugar threshold should a village set?** WHO says 10 per cent, conditionally 5. Sheiham and James say 2 to 3. The evidence does not choose.
- **What is the real case fatality of untreated noma?** The 90 per cent figure is in every paper and in no original study I could reach.
- **Which field fluoride test survives the Fall?** Whether water is at 0.5 or 5 mg/L changes everything, and no field test for abrasive particle size exists either.

9. Sources to read in full

1. **Gustafsson BE and others (1954)**, Vipeholm, for the group design and the increments.
2. **Moynihan PJ and Kelly SA (2014)**, for the GRADE table separating the 10 and 5 per cent claims.
3. **Sheiham A and James WPT (2014)**, for the Japanese and Tristan reanalyses.
4. **Hujoel PP and others (2018)**, the uncomfortable one. Read it before writing any routine.
5. **Dickson M, Where There Is No Dentist**, Hesperian, chapters 1 to 5. The model for this chapter.
6. **Crittenden AN and others (2017)**, the Hadza, and the antidote to Price.
7. **Price WA (1939)**, chapters 3 and 4. Read the tables, not the conclusions.
8. **Alharbi and others (2025)**, the miswak review, with its two null fresh-against-inactivated trials.
9. **Merck Manual, Acute Necrotizing Ulcerative Gingivitis.** Short, and the debridement-first rule is what a healer must know.

At the bedside after the Fall

For a household. One rule and one habit. The rule: everything sweet is eaten at a meal and nothing between meals. The habit: every mouth cleaned once a day with a chewed stick or a cloth on a finger, adults doing the small children's. *To start:* a known-safe species identified by someone who is sure, a clean cloth, salt, and the willingness to tell a child no. *First failure to expect:* the honey. Everyone agrees about sugar and nobody counts honey, cane juice, molasses or dried fruit as sugar. Hadza bush men, eating nothing from a shop, had more caries than villagers because of honey.

For a village of 300. The household rule made public, plus weekly collective cleaning of all children under six supervised by a named adult, plus one annual look into every mouth with a written record. *To start:* a coppiced stand planted in year one, because a wild stand is exhausted in five. A forged hand scaler. A register of name, age, teeth present, bleeding, pockets and date. Someone who has read the Hesperian prevention chapters and taught them. A sugar decision written down and tied to the FEASTING book. *First failure to expect:* the register, abandoned in year two, after which nobody can tell whether the sugar rule worked.

For a district of 3,000. All of the above, plus water fluoride known for every source, bone char defluoridation where it is high, training and audit for village healers, and one place where facial infections are drained and noma is treated. *To start:* a way to measure fluoride, a kiln and a bone supply, a nurse who will scale and extract and teach, and records comparable across villages. *First failure to expect:* the filters. They work for four to thirteen months, nobody replaces the char, and the fluorosis returns unnoticed until the children's teeth mottle again.

Protocols

Protocol 1. The household daily routine

- ☐ Once a day, at a fixed time, clean every tooth. Carefully once beats carelessly four times, with a chewed stick of a **named** species, a soft brush, or a cloth on a finger.
- ☐ Prepare a stick: a green twig 15 to 20 cm long, 5 to 8 mm thick, 1 cm of bark stripped from one end, that end chewed until the fibres separate. Trim it every day or two, discard after a week.
- ☐ Scrub tops and both sides of every tooth, especially the grooves, then push the fibres between them. Reach the back teeth, where decay starts and cleaning is skipped.
- ☐ Water is enough. Salt or sieved charcoal, if used, a pinch, rubbed between finger and thumb first to check it does not grit. Spit, never swallow.

Protocol 2. The sugar rule

- ☐ Count free sugars: honey, cane juice, molasses, syrup, sweets, dried fruit, sweet drinks. Not whole fruit at a meal, not starch.
- ☐ Adult ceiling **under 25 g a day**, stretch target **10 to 15 g** where other energy is sufficient. No safe minimum.
- ☐ **Frequency matters more: all sweet things at meals, none between.** Group them into one sitting, once a week if you can.
- ☐ Never anything sweet in a bottle or a night cup for a child.
- ☐ Exempt absolutely: oral rehydration solution, and sugar for anyone starving, feverish, recovering or pregnant. Teeth never outrank survival.
- ☐ After anything sweet, rinse with plain water. Do not brush for 30 minutes if it was acid too [VERIFY, standard advice, not sourced here].

Protocol 3. A baby's and a small child's mouth

- ☐ Birth to first tooth: wipe the gums after feeds with a cloth over a finger, dipped in boiled salted water.
- ☐ From about 6 months: wipe the new teeth with a clean cloth after eating.
- ☐ From about 1 year: brush with **water only**, all surfaces. An adult does it daily until school age.
- ☐ **Never juice or sweet tea in a bottle.** Night feeding after 12 months raises caries risk about sevenfold in the pooled data.
- ☐ Look in the mouth weekly in a hungry season. Grey, dying gum tips mean act today.

Protocol 4. The village cleaning session

- ☐ One named adult per 8 to 10 children under six, daily, at a fixed time. Benefit rises with years of exposure.
- ☐ One marked stick or brush per child, kept dry, never shared. Replace sticks weekly, brushes when the bristles splay.
- ☐ Two minutes per child, adult-led, all surfaces. Record attendance, the only way to know whether it worked.

Protocol 5. Warm salt-water rinse

- ☐ One level teaspoon of salt, about 5 g, in about 250 mL of warm water [VERIFY, household recipe, not a trial dose]. Comfortable on the inside of the wrist, never hot.
- ☐ **Twice a day.** Six times was no better than twice in the randomised trial.
- ☐ Move it gently round the mouth for 30 seconds. Spit. Do not swallow.
- ☐ Use after any extraction, mouth injury, ulcer or bleeding gums, but not on a fresh socket until the next day.
- ☐ Anyone on a salt restriction for heart or kidney disease must not swallow any of it.

Protocol 6. Bleeding gums, first line

- ☐ Confirm gingivitis: red, swollen, bleeding margins, no loose teeth, no pus, no fever. Clean every tooth daily, gum margin included, even though it bleeds. The bleeding is the reason to clean, not to stop. Salt rinses twice a day.
- ☐ Expect improvement in 7 to 14 days. Bleeding unchanged at 14 days means calculus below the margin, needing scaling.
- ☐ Loose teeth, pus or pain mean this is not simple gingivitis. See Protocol 7 or the red flags.

Protocol 7. Acute necrotising ulcerative gingivitis

- ☐ Recognise: sudden severe pain, punched-out ulcerated gum tips, grey slough, bleeding on the lightest touch, foul breath, often fever and tender neck glands, in a stressed, hungry or smoking patient.
- ☐ **Debridement is the treatment. The rinse is not.** Chlorhexidine and povidone iodine were ineffective in the acute phase without it.
- ☐ Day 1: irrigate gently with warm salt water and remove the loose slough and as much soft deposit as the patient tolerates. Do not try to do it all.
- ☐ Days 2 to 4: repeat daily, a little deeper as pain falls. **Marked improvement usually comes within 24 to 48 hours.** Dilute hydrogen peroxide in warm water, if any exists, as an irrigant.
- ☐ Antibiotic **only if debridement must wait** or the patient is febrile and unwell: metronidazole 500 mg, or amoxicillin 500 mg, by mouth every 8 hours, adult doses. Never metronidazole with alcohol.
- ☐ Feed soft, energy-dense food several times a day. Stop tobacco and betel.
- ☐ Review at 48 hours. **If it is not clearly better, or there is facial swelling or a dusky patch of cheek, treat as noma and send for the district.**
- ☐ Once it settles, complete the scaling and start the daily routine, or it returns.

Protocol 8. Scaling, for a trained lay healer only

- ☐ Do not scale anyone with a known murmur or valve disease without antibiotic cover, or anyone with a bleeding disorder.
- ☐ Instruments: a forged sickle scaler and a straight scaler, sharpened, boiled or alcohol-soaked before each patient.
- ☐ Work one sextant at a time, hand resting on the teeth, not the face. Angle the blade against the calculus, not the root, and pull away from the gum.
- ☐ Irrigate with warm salt water as you go. Stop if pain is not tolerable and spread the work over visits.
- ☐ Salt rinses twice daily for a week after. Review at 6 weeks, when bleeding should have stopped. Repeat in 6 to 12 months.

Protocol 9. Deciding whether your water has too much fluoride

- ☐ Look at the children. Dental fluorosis is chalky white flecks and lines, worse cases brown staining and pitting, on **both sides symmetrically**. Decay is asymmetric, fluorosis is symmetric.

- ☐ If more than a few children show it, suspect the water source and change it if another exists. In adults look for stiffness, joint pain and calcified ligaments: skeletal fluorosis takes years and does not reverse.
- ☐ Suspect brick tea, or any tea drunk in very large quantities, as a separate source.
- ☐ If no alternative source exists, filter. Protocol 10.

Protocol 10. Bone char fluoride filter, household scale

- ☐ Char them in a closed vessel or pit kiln until black through, not white. White means over-burnt, adsorption lost [VERIFY, standard appropriate-technology guidance, not sourced here].
- ☐ Take clean bones, defleshed, boiled and dried. Crush and sieve the char to a coarse grit, not a powder, so water flows through.
- ☐ Build: a 20 L bucket with a tap near the base, a false floor of cloth over gravel, and **10 kg of bone char** on top.
- ☐ Expect 10.5 mg/L down to under 1 mg/L, sustained **4 to 13 months**.
- ☐ Replace the char on a schedule at the short end of that range, not when taste or teeth tell you. Efficiency falls silently. Mark the date on the bucket.

Protocol 11. Choosing and managing a chewing-stick tree

- ☐ Choose **one or two species** for the village, by name, taught by leaf, bark, break and smell.
- ☐ Candidates: *Salvadora persica* in arid country, *Azadirachta indica* where neem grows, *Garcinia kola* or *Zanthoxylum zanthoxyloides* in West African forest, with bamboo, sugar cane skin and coconut husk as Hesperian's fallbacks.
- ☐ **No improvised sticks from unknown shrubs, ever.** An unidentified twig chewed twice a day is an unidentified plant extract taken twice a day.
- ☐ Test a new species on one adult volunteer for two weeks first, watching for burning, ulceration, numbness or nausea. If several people bleed, abandon it.
- ☐ Plant a coppice stand in year one and cut on rotation. Never strip a wild stand.

Numbers to carry

1. **pH 5.5.** Below it enamel dissolves, above it rebuilds. Every sugar exposure buys 30 to 60 minutes below the line.
2. **0.27 against 4.02.** New carious surfaces a year at Vipeholm: 30 g of sugar at meals against 300 g with sticky sweets between.
3. **25 g a day.** WHO's conditional ceiling on free sugars for an adult. Sheiham and James argue for 10 to 15 g.
4. **Minus 0.11 DMFS.** Oral hygiene on caries without fluoride, straddling zero. Clean for the gums, cut sugar for the cavities.
5. **24 per cent.** The prevented fraction of fluoride toothpaste, 70 studies, 42,300 children. This is what is lost when the factories stop.
6. **5 mg of fluoride per kg body weight.** The probably toxic dose, reached by under two ounces of ordinary toothpaste in a 10 kg child.
7. **Twice a day.** Warm salt rinses after an extraction. Six times was no better.
8. **24 to 48 hours.** Acute necrotising gingivitis should visibly improve after debridement. If not, treat it as noma.
9. **12 months.** The age after which night breastfeeding raises caries risk about sevenfold.
10. **4 to 13 months.** How long 10 kg of bone char in a 20 L bucket holds fluoride below 1 mg/L. Replace on a date, not a taste.

References

1. Gustafsson BE, Quensel CE, Lanke LS, Lundqvist C, Grahnen H, Bonow BE, Krasse B. 1954. The Vipeholm dental caries study: the effect of different levels of carbohydrate intake on caries activity in 436 individuals observed for five years. Acta Odontologica Scandinavica 11(3-4):232-264. Read only through search summaries of the paper and secondary accounts, not the original text. https://medicaljournalssweden.se/actaodontologica
2. Wikipedia. Vipeholm experiments. Read in full. Source of the dates, subject numbers, funders, publication delay, and the Krasse and Swedish ombudsman judgements. https://en.wikipedia.org/wiki/Vipeholm_experiments
3. Procter and Gamble dentalcare.com. Caries Process, Prevention and Management, continuing education course CE713, modules on the Stephan curve, the Vipeholm study, Hopewood House and sugars intake. Read. A commercial education site, used for textbook-level consensus, not primary data. https://www.dentalcare.com/en-us/ce-courses/ce713
4. Moynihan PJ, Kelly SA. 2014. Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. Journal of Dental Research 93(1):8-18. Read through search summaries of the abstract, the Newcastle eprints record and the National Elf Service commentary. https://pubmed.ncbi.nlm.nih.gov/24323509/
5. Sheiham A, James WPT. 2014. A new understanding of the relationship between sugars, dental caries and fluoride use: implications for limits on sugars consumption. Public Health Nutrition. Full text read via the Cambridge Core reader. Source of the Tristan, Takeuchi, Buttner, Miyazaki and Morimoto, Szpunar, Australian and Irish figures and the 2 to 3 per cent recommendation. https://www.cambridge.org/core/product/0FF6455AFB95AAE91DBD1636C3DE2C7C/core-reader
6. Sheiham A, James WPT. 2014. A reappraisal of the quantitative relationship between sugar intake and dental caries. BMC Public Health 14:863. Abstract and secondary summaries only. The full text was not reachable at the original URL, which redirects. https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-14-863
7. World Health Organization. 2015. Guideline: sugars intake for adults and children. Known here through the summaries in references 4 and 5.
8. Nederlands Tijdschrift voor Tandheelkunde, historical archive on Tristan da Cunha, citing Sognnaes and Holloway and others. Read via search summary only, in Dutch. Sognnaes's own report was not read, and its date differs between catalogue records (1951) and later bibliographies (1954). https://ntvt.nl
9. Sullivan HR, Goldsworthy NE. 1958. Hopewood House study. Not read. Harris R. 1963. Biology of the children of Hopewood House. Journal of Dental Research 42:1387. Not read. Known through the secondary summaries in reference 3 and the Find and Connect entry. https://findandconnect.gov.au/entity/hopewood-2
10. Crittenden AN, Sorrentino J, Moonie SA, Peterson M, Mabulla A, Ungar PS. 2017. Oral health in transition: the Hadza foragers of Tanzania. PLoS ONE. Full text read. Source of all Hadza figures and of the Palaeolithic 2 per cent and Turner fivefold citations. https://pmc.ncbi.nlm.nih.gov/articles/PMC5351833/
11. Current Anthropology. 2019. Metastudy of dental lesions across 185 archaeological sites. Read via search summary only, including the over 70 per cent overlap, the null results for tooth loss and abscesses, and the Levant and Ukraine figures. https://www.journals.uchicago.edu/toc/ca/2019/60/3
12. Price WA. 1939. Nutrition and Physical Degeneration, chapters 3 and 4, read in full online. All Price figures come from those two chapters. https://www.journeytoforever.org/farm_library/price/pricetoc.html
13. Wikipedia. Weston A. Price. Read. Source of the Hooton foreword, the 1940 Canadian Medical Association Journal review and the summary of the Jarvis critique in Nutrition Today, which I did not read directly. https://en.wikipedia.org/wiki/Weston_A._Price
14. Alharbi and others. 2025. Antibiofilm properties of miswak (Salvadora persica) compared to conventional oral health measures: a systematic review. Full text read. Source of the ten trials, 442 adults, the Sofrata 2011 and Zarabadipour 2020 null results, the constituent list, and the note that the WHO endorsement is cited to a review article rather than a WHO document. https://pmc.ncbi.nlm.nih.gov/articles/PMC12140835/

15. Mohd Said S, Mohd Dom TN. 2022. Meta-analysis of miswak versus toothbrush for plaque and gingivitis. Journal of Ethnopharmacology, doi:10.1016/j.jep.2022.115598. Abstract via search summary only. Source of the standardised mean differences.
16. Darout IA, Albandar JM, Skaug N. 2000. Periodontal status of adult Sudanese habitual users of miswak chewing sticks or toothbrushes. Acta Odontologica Scandinavica. Abstract read via search summary. https://medicaljournalssweden.se/actaodontologica/article/view/39101
17. Wikipedia. Miswak. Read. Source of the contested 1986 or 1987 WHO date and of the description of the 2000 International Dental Journal consensus. https://en.wikipedia.org/wiki/Miswak
18. Dickson M. Where There Is No Dentist. Hesperian Health Guides, first edition 1983, current web edition. Pages read in full: the table of contents, Clean Your Teeth Every Day, Taking Care of All Your Teeth, Taking Care of Baby Teeth. The hard-wood and cloth-on-a-stick advice comes from a search summary of other pages in the same book. https://en.hesperian.org/hhg/Where_There_Is_No_Dentist
19. Hujoel PP, Hujoel MLA, Kotsakis GA. 2018. Personal oral hygiene and dental caries: a systematic review of randomised controlled trials. Gerodontology 35(4):282-289, doi:10.1111/ger.12331. Abstract read via search summary, with the Dental Elf commentary and an interview with Hujoel. https://pubmed.ncbi.nlm.nih.gov/29766564/
20. Marinho VCC, Higgins JPT, Sheiham A, Logan S. 2003. Fluoride toothpastes for preventing dental caries in children and adolescents. Cochrane Database of Systematic Reviews CD002278. Abstract and plain-language summary read. https://www.cochrane.org/evidence/CD002278_fluoride-toothpastes-preventing-dental-caries-children-and-adolescents
21. Walsh T, Worthington HV, Glenny AM and others. 2010, updated 2019. Fluoride toothpastes of different concentrations for preventing dental caries. Cochrane CD007868. Abstract and summary read. https://cochranelibrary.com/cdsr/doi/10.1002/14651858.CD007868.pub3/pdf/CDSR/CD007868/CD007868_abstract.pd
22. Valkenburg C, Kashmour Y, Dao A, Van der Weijden GAF, Slot DE. 2019. The efficacy of baking soda dentifrice in controlling plaque and gingivitis: a systematic review. International Journal of Dental Hygiene. Read via search summary of the PMC record and the Dental Elf commentary. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6850485/
23. Valkenburg C and others. Does dentifrice use help to remove plaque? A systematic review. Amsterdam UMC repository PDF, read via search summary. https://pure.amsterdamumc.nl/ws/files/159980551/Does-dentifrice-use-help-to-remove-plaque-a-systematic-review.pdf
24. Brooks JK, Bashirelahi N, Reynolds MA. 2017. Charcoal and charcoal-based dentifrices: a literature review. Journal of the American Dental Association 148(9):661-670. Not read directly. Known through the university press release, the Dental Tribune report and a Brazilian secondary review. https://www.newswise.com/articles/review-claims-of-safety-oral-benefit-of-charcoal-dentifrice-usage-remain-unproven
25. Jong and others. 2023. The effect of oil pulling in comparison with chlorhexidine and other mouthwash interventions in promoting oral health: a systematic review and meta-analysis. International Dental Journal, doi:10.1111/idh.12725. Abstract and Dental Elf commentary read via search summary.
26. Kuroyama M and others. 2015. Exogenous lipoid pneumonia caused by repeated sesame oil pulling: a report of two cases. BMC Pulmonary Medicine 15:135, doi:10.1186/s12890-015-0134-8. Abstract read via search summary. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4628246/
27. Dean HT. 1942. The 21 Cities Study. Not read. Known through the CDC water fluoridation timeline and CDC MMWR retrospective PDFs. https://www.cdc.gov/fluoridation/timeline-for-community-water-fluoridation/index.html
28. Centers for Disease Control and Prevention and associated MMWR retrospectives on Grand Rapids and the four city pairs from 1945. Read via search summary of CDC pages and PDFs. https://stacks.cdc.gov/view/cdc/27197/cdc_27197_DS1.pdf
29. Demelash H and others. 2019. Fluoride concentration in ground water and prevalence

of dental fluorosis in Ethiopian Rift Valley: systematic review and meta-analysis. BMC Public Health 19, doi:10.1186/s12889-019-7646-8. Read via search summary of the PDF. https://bmcpublichealth.biomedcentral.com/track/pdf/10.1186/s12889-019-7646-8

30. Dahi E and others. Bone char based bucket defluoridator in Tanzanian households, and the contact precipitation method. Technical University of Denmark Orbit records and EAWAG Sandec News. Read via search summary. Source of the 10 kg char in 20 L, the 4 to 13 month result, the 95 to 98 per cent contact precipitation figure and the Nalgonda labour note. https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/WST/SN12_Fluoride_Ethiopia.pdf
31. Fung KF, Zhang ZQ, Wong JWC, Wong MH. 1999. Fluoride contents in tea and soil from tea plantations and the release of fluoride into tea liquor during infusion. Environmental Pollution. Read via search summary, with the Malaysian, Polish and Chinese market studies found in the same searches.
32. Biomedical and Environmental Sciences and related Chinese surveys of brick tea fluorosis in Tibet and Qinghai. Read via search summary of the besjournal PDF. Source of the 33.57 and 46.06 per cent figures and the 261.7 to 875.8 mg/kg leaf range. https://www.besjournal.com/fileSWYXYHJKX/journal/article/swyxyhjkx/2021/4/PDF/20246.pdf
33. Wikipedia, Fluoride toxicity, with lecture PDFs from dental faculties read via search summary. Source of the probably toxic dose of 5 mg/kg, the toothpaste worked example and the conflicting lethal dose estimates, which are reported here as conflicting. https://en.wikipedia.org/wiki/Fluoride_toxicity
34. UK Committee on Toxicity statement on fluoride, and the Food Standards Australia New Zealand supporting document on the derivation of the fluoride upper level. Read via search summary. Source of the 0.05 mg/kg/day NOAEL, the McClure origin and the 0.10 mg/kg/day upper level with the note that its derivation was not fully described. https://cot.food.gov.uk/sites/default/files/cot/fluoride.pdf
35. Changes in the global burden of untreated dental caries from 1990 to 2019. Read via search summary of the PMC record. Source of the 2.03 billion prevalent cases and the 46.07 per cent rise. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9526157/
36. Frontiers in Oral Health. 2025. Secondary report of GBD 2019 and 2021 severe periodontitis figures. Read via search summary. https://www.frontiersin.org/journals/oral-health/articles/10.3389/froh.2025.1609961/pdf
37. Sanz M and others. 2020. Periodontitis and cardiovascular diseases: consensus report. EFP and World Heart Federation workshop, Global Heart, doi:10.5334/gh.400. Abstract and secondary summaries only. Full text not obtained, so no effect size is attributed to it directly.
38. Meta-analyses of periodontal treatment and HbA1c (2013 and 2015), of periodontitis and preterm birth (37 observational studies, OR 2.20), and of periodontal treatment in pregnancy (13 trials, RR 0.90, and a broader review, RR 0.77). All read via search summaries of PMC records. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4490675/
39. Merck Manual and MSD Manuals, professional version. Acute Necrotizing Ulcerative Gingivitis. Read via search summary. Source of the debridement-first rule, the 24 to 48 hour window and the metronidazole and amoxicillin doses. https://www.msdmanuals.com/professional/dental-disorders/periodontal-disorders/acute-necrotizing-ulcerative-gingivitis-anug
40. South African Dental Journal, case report describing a 1975 regimen for necrotising ulcerative gingivitis. Read via search summary. Source of the finding that chlorhexidine and povidone iodine were ineffective acutely without debridement. https://scielo.org.za/pdf/sadj/v70n5/07.pdf
41. Estimated incidence and clinical presentation of noma in Northern Nigeria 1999-2024. PLOS Neglected Tropical Diseases 2025. Read via search summary of the PMC record. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC12143531/
42. Wikipedia, Noma (disease), with the PLOS Neglected Tropical Diseases 2023 paper on paediatric noma admissions in northwest Nigeria. Read via search summary. Source of the WHO staging, the 90 per cent untreated case fatality claim and its untraced origin, the 1998 WHO estimate of 140,000 cases a year, and the malnutrition and absent-chickens risk factors. https://en.wikipedia.org/wiki/Noma_(disease)

43. Royal Australian College of General Practitioners, Australian Journal of General Practice 2020, Dental abscess: death and morbidity, reproducing a 2005 Australian Dental Journal review. Read via search summary. Source of the 10 to 40 per cent pre-antibiotic fatality range. https://www1.racgp.org.au/ajgp/2020/september/dental-abscess-death-and-morbidity
44. Kansas Journal of Medicine and a Moldovan literature review on Ludwig's angina. Read via search summary. Source of the above 50 per cent pre-antibiotic and under 8 to 10 per cent modern mortality figures, which disagree with reference 48. https://journals.ku.edu/kjm/article/download/15986/15318
45. Tham R and others. Breastfeeding and the risk of dental caries: a systematic review and meta-analysis. Read via search summary and the Australian Catholic University repository PDF. Source of the OR 0.50, 1.99 and 7.14 figures. https://acuresearchbank.acu.edu.au/download/f40b98612e53673e3ef23de3db4f0edff41cebef0ed5a49ccf444c5858f87d75/3
46. Avila WM and others. 2015. Breast and bottle feeding as risk factors for dental caries: a systematic review and meta-analysis. PLoS ONE. Read via search summary of the PMC record. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4651315/
47. Anopa Y, McMahon AD, Conway DI, Ball GE, McIntosh E, Macpherson LMD. 2015. Improving child oral health: cost analysis of a national nursery toothbrushing programme, with the associated Childsmile cohort analyses. Read via search summary of the REF 2021 impact case study and the NIHR Evidence alert. Source of the 99,071 and 50,379 child cohorts and the cost figures. https://results2021.ref.ac.uk/impact/a4ae0aad-10f1-47db-aa80-a1fbec76714d/pdf
48. Gao SS, Zhang S, Mei ML, Lo ECM, Chu CH. 2016. Clinical trials of silver diamine fluoride in arresting caries among children: a systematic review. JDR Clinical and Translational Research. Read via search summary of the AAPD-hosted PDF. https://www.aapd.org/globalassets/media/events/gao-et-al-2016-clinical-trials-of-silver-diamine-fluoride-in-arresting-caries-among-children-a-systematic-review.pdf
49. Randomised trial of warm saline gargles after extraction, 120 patients, and a review of eight randomised trials of saltwater for dry socket. Read via search summaries of the National Elf Service commentaries. https://nationalelfservice.net/dentistry/oral-and-maxillofacial-surgery/trial-suggests-that-post-extraction-use-of-warm-saline-mouth-rinse-reduces-complications
50. Wikipedia. Salt rinse. Read. Source of the note that the mechanism is unexplained and of the negative sea-salt rinse study. https://en.wikipedia.org/wiki/Salt_rinse
51. Nigerian and Ghanaian chewing stick studies: antibacterial activities of extracts from Nigerian chewing sticks, the Garcinia kola GB1 biflavonoid work, the Fagara zanthoxyloides alkaloid pH work, the neem root extract study, and an ethnomedicinal survey of chewing sticks in Idanre Forest Reserve, Ondo State. All read via search summary. https://ffps.org.ng/journal/2019/vol_12/ethno_medicinal_survey_of_chewing_sticks_in_idanre_forest_reserve_ondo_state
52. THRIVING library, FO-06. The manuals that worked. Read in part. Source of the Babu and Eisenberg audit figures and the observation that prevention advice ages well.
53. THRIVING library, HY-08. Deficiency diseases and how to prevent them with what grows. Read in part. Relied on for the rule that dietary restriction must never cost energy in a hungry population.
54. THRIVING library, WO-11. Pain relief and local anaesthesia. Read in part. Source of the clove and benzocaine trial grading.
55. THRIVING library, WO-14. Tetanus. Read in part. Source of the spatula test and the trismus differential.
56. THRIVING library, IN-05. Antibiotics. Read in part. Source of metronidazole's WHO Access classification and its role in dental abscess.