WO-16 Eye, ear and dental emergencies: foreign bodies, corneal ulcer, extraction and the abscess

HEALING after the FALL, research library, WO-16

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How to read this

Three organs, one face, one healer. The eye forgives nothing and heals in days or scars for life. The ear is mostly self-correcting and mostly ruined by the person trying to help. The tooth is the one place in the body where a lay healer with four instruments can cure a disease outright, and the one place where a neglected infection can kill a healthy adult in two days. The grades, the ledger and the harm test are given once for each procedure rather than repeated.

Two library documents sit under this one. HY-12 covers prevention of decay and gum disease, the chew stick, the sugar rule and acute necrotising gingivitis, and this report does not repeat it (THRIVING library, HY-12). WO-11 covers the dental block, clove and the lidocaine ceiling (THRIVING library, WO-11). WO-14 covers abscess drainage in general and the no-packing finding (THRIVING library, WO-14). CH-07 on restorations and CH-08 on trachoma were named in my brief as cross-references but do not exist in the library folder, so I have covered the minimum of both here.

1. Findings by section

1.1 The eye: what a healer can see, and the five questions

The WHO AFRO *Primary Eye Care Training Manual* (2018) is the most useful document I found for this book, because it assumes a torch, a record card and nothing else (WHO AFRO 2018). Its examination is five observations. The white should be completely white apart from a few red veins. The black should be completely black. The eyes should be the same size. The eyes should look straight ahead. The lids should open and close normally, with lashes facing outwards. Then distance vision is measured, near vision in anyone over 40, and the finding is written down.

That last step is the one a village will drop and the one that matters most. A cornea that was black yesterday and grey today is an emergency. Without a written record from yesterday nobody can tell.

The manual's red-eye algorithm turns on vision and pain. Red eye with normal vision, no pain, no discharge and no itch is reassurance. Red eye with discharge is washing plus a topical antibiotic, with review in two days. Red eye with itching and watering is washing with cold water. Red eye with moderate to severe pain, or any abnormal vision, is urgent referral with a painkiller given first (WHO AFRO 2018). After the Fall there is nowhere to refer to, so the village must learn what the referral centre would have done, which is the rest of this section.

One honest caution about the whole approach. Taylor and colleagues tested the standard primary-care eye signs against specialist diagnosis in African eye clinics and found the sensitivity and specificity of commonly used symptoms

and signs too low to guide accurate referral by primary health care workers (reported in Human Resources for Health 2014). The algorithm is better than nothing. It is not a diagnosis.

1.2 The foreign body on the surface

Most eye foreign bodies are superficial, on the conjunctiva or under the upper lid, and come out with a moistened cotton bud or the moistened corner of a clean cloth. The WHO method is: anaesthetic drop if there is one, look at the white of the eye, lift the object off with a moistened bud with a gentle upward movement, and if nothing is visible evert the upper lid and look inside it. Show the object to the patient afterwards, because that is what convinces them the pain will stop, and ask them to come back the next day if it has not (WHO AFRO 2018).

Lid eversion is the manoeuvre most worth teaching, because a subtarsal foreign body produces vertical scratch lines on the cornea and a patient who is sure something is still in there. Ask the patient to look down, hold the upper lashes between thumb and index finger, lay a cotton bud or pen top across the lid about midway from the margin, and turn the lid back against it. Looking up releases it.

The absolute rule: never evert the upper lid if a penetrating injury or corneal thinning from ulceration is suspected (WHO AFRO 2018). Pressure on a perforated or thinned globe expresses its contents.

A metal fragment embedded in the cornea is a different problem. Rust begins to stain the cornea 2 to 4 hours after embedding and the ring is complete by about 8 hours (RCEM Learning, undated, Patient Care Online, undated). Removal needs magnification. A needle takes up to twice as long as a burr, and a burr risks breaching Bowman's membrane with permanent scarring, which is why many ophthalmologists discourage burr use even by emergency doctors. One useful observation for a village: a rust ring is often easier to lift 2 to 3 days after presentation, because local necrosis separates it from the epithelium (RCEM Learning). A healer with a steady hand, a magnifying lens, a sterilised fine needle and a topical anaesthetic can take a superficial corneal foreign body off the periphery. Nobody should go near one on the visual axis unless the alternative is certain blindness.

1.3 The corneal abrasion, and the one prophylaxis question that matters

The single most consequential finding in this report is also the one the evidence has turned against.

Upadhyay and colleagues followed 34,902 people in Bhaktapur, Nepal for two years with 81 primary eye care workers (Upadhyay 2001). They counted 551 corneal abrasions, an annual incidence of 789 per 100,000, and 558 corneal ulcers, 799 per 100,000. They enrolled 442 abrasion patients presenting within 48 hours and gave 1 per cent chloramphenicol ointment three times a day for three days. Of these, 424 (96 per cent) healed without infection. The timing finding is the famous one. **None of the 284 who started treatment within 18 hours of injury developed an ulcer.** Four of 109 (3.7 per cent) who started at 18 to 24 hours became infected, and 14 of 49 (28.6 per cent) who started at 24 to 48 hours ulcerated. A Bhutan programme reported no ulceration at all in treated abrasions against 301 per 100,000 in surrounding control districts, and Myanmar reported similarly low rates (O'Brien 2015). None of these had a randomised untreated control.

Then the VIEW trial tested it properly. Villages in Chitwan and Nawalparasi, Nepal were cluster-randomised, female community health volunteers in intervention villages were trained to diagnose abrasions and give a three-day course of ophthalmic antimicrobials, and corneal photographs were assessed masked. The result was flat: 289 ulcers in 246,893 intervention person-years against 262 in the control arm, 1.21 against 1.18 per 1000 person-years, incidence rate ratio 1.03 (95 per cent CI 0.63 to 1.67, p = 0.93) (O'Brien and others, VIEW trial, NCT01969786). No reduction over three years.

How should the book read this? Not as proof that ointment on a fresh abrasion is useless. The trial tested a programme, not a drug, and the authors themselves suggested further study in more rural areas without basic eye care. What it does show is that the 18-hour effect in the uncontrolled studies was probably at least partly selection: people

who reach a health worker within 18 hours are different from people who reach one on day two. **The honest version for the book is: clean the eye, cover it if that comforts, put antibiotic ointment in if you have any and it is within hours, look at the eye every day for four days, and do not believe that the ointment has bought you safety.** The daily look is the intervention that survives both studies.

Patching, meanwhile, is out. The Cochrane review by Lim, Turner and Lim (2016, CD004764) found patched eyes possibly less likely to be healed at 24 hours (low certainty), no difference at 48 and 72 hours (moderate certainty), healing probably slightly slower with a patch, and pain possibly worse at 24 hours. A pad is comfort, not treatment, and a pad over an infected eye is a warm incubator.

1.4 The corneal ulcer: the farmer's eye

An ulcer is an abrasion that has been colonised. On a torch examination it is a white or grey patch in the black of the eye, with redness worst around the edge of the cornea, pain, watering, light sensitivity and falling vision. A layer of pus in the bottom of the anterior chamber, a hypopyon, means the infection is advanced. Fluorescein, if any has survived the Fall, stains the epithelial defect green.

The burden is large and almost entirely rural. The Madurai district study found a recorded incidence of 3.4 per 10,000 per year and a corrected estimate, after questioning practitioners and checking records, of 11.3 per 10,000, which is 113 per 100,000, about ten times the 11 per 100,000 of Olmsted County in the United States (Gonzales and others 1996, read through secondary summaries). Globally microbial keratitis is estimated to cause 1.5 to 2 million cases of unilateral blindness a year, probably an undercount (Ung and others 2019).

What causes them matters for what a village can do. At Aravind, among 434 patients with central corneal ulceration, 65.4 per cent gave a history of previous corneal injury and 68.4 per cent had positive cultures, of which 140 (47.1 per cent) were pure bacterial and 139 (46.8 per cent) pure fungal, the commonest bacterium being *Streptococcus pneumoniae* (Srinivasan 1997). In tropical climates fungi account for roughly 20 to 60 per cent of culture-positive corneal infections, with *Fusarium* and *Aspergillus* dominant, and vegetative trauma is the leading predisposing event. North Indian and south Indian series put agricultural trauma with plant twigs, sticks, wood chips or vegetative matter at 41 to 55 per cent of fungal cases (Brown and others 2021, and regional series read through summaries).

This is the single most important epidemiological fact in this report for a post-Fall village. **A farming population, working by hand among stalks and thorns, with no antifungals at all, will see fungal keratitis after plant injury to the eye, and will not be able to treat it.** The MUTT I trial showed what treatment is worth: among 323 patients with smear-positive filamentous fungal ulcers, natamycin 5 per cent gave better three-month vision than voriconazole 1 per cent (regression coefficient minus 0.18 logMAR, 95 per cent CI minus 0.30 to minus 0.05, p = 0.006) and fewer perforations or therapeutic keratoplasties (OR 0.42, 0.22 to 0.80, p = 0.009), with the effect concentrated in *Fusarium* (OR for perforation 0.06, 0.01 to 0.28) (Prajna 2013). Natamycin is a fermentation product of *Streptomyces natalensis*. It cannot be improvised. The prevention, which is a cloth or a woven shade over the eyes during threshing and brush clearing, is the whole of what a village has.

For bacterial ulcers there is one remarkable salvageable option. Isenberg and colleagues randomised 172 adults with bacterial keratitis in the Philippines and India to povidone-iodine 1.25 per cent or a local antibiotic (neomycin-polymyxin-gramicidin or ciprofloxacin 0.3 per cent). Infection resolved in 54 per cent of povidone-iodine eyes and 52 per cent of antibiotic eyes (Isenberg 2017, read through abstract and three secondary reports). The caveats are heavy: all patients were hospitalised at least seven days and nurses instilled drops hourly around the clock for three days. An earlier double-masked trial of 459 children in Manila with acute conjunctivitis found povidone-iodine 1.25 per cent four times daily no different from neomycin-polymyxin-gramicidin for days to cure or proportion cured at one and two weeks (Isenberg, year not confirmed in sources read) [VERIFY].

This matters because povidone-iodine is the one topical antimicrobial a district might conceivably still have, or dilute down from a surgical stock, long after every antibiotic is gone. A 10 per cent surgical solution diluted eightfold in

boiled cooled water is 1.25 per cent. I did not find a trial of a village-made dilution, and the osmolarity and buffering of a home dilution are not those of the trial product, so this is an inference [VERIFY]. It is nonetheless the highest-value idea in this report.

Honey has been tried on the cornea and the record is thin. An Egyptian series treated 18 eyes with corneal ulcers and keratitis resistant to conventional treatment for more than three months with pure bee honey drops four times daily, reporting a dramatic response in 14 within two to three weeks (Mansour, 1991, read through secondary summary). There was no control. A 2023 prospective comparison of 45 eyes with non-responding infected keratitis found honey-based drops comparable to topical insulin and autologous serum, 15 eyes per group, no significant difference (Dalia and others 2023, abstract). A case of *Acanthamoeba* keratitis followed topical honey given by a traditional therapist (case report read through summary). Raw honey is not sterile. Grade D at best, and the contamination risk in an eye is far worse than on a leg wound.

1.5 Chemical burns and irrigation

This is the one eye emergency where a village can equal a hospital, because the treatment is water and time.

WHO AFRO's instruction is blunt: this is an emergency, prompt and thorough action is vital, do not delay to check visual acuity, proceed to irrigation immediately. Method: anaesthetic drop if available, patient sitting or lying with neck and shoulders protected, head tilted so fluid does not run into the good eye, lids spread open, fluid poured slowly and steadily from no more than 5 cm onto the front of the eye and inside the lower lid and under the upper lid, copious amounts, the upper lid everted, the patient moving the eye in all directions throughout, for at least 15 minutes and 30 minutes is better (WHO AFRO 2018). Saline or buffer if available, otherwise clean water at room temperature.

I must flag an internal contradiction in that manual: its trauma algorithm says "Irrigation for 10 minutes" while its skill protocol says at least 15 and preferably 30 (WHO AFRO 2018). The clinical literature sides with the longer figure. The Royal Victoria Eye and Ear Hospital guideline and the Wills Eye manual both give at least 30 minutes for acid and alkali, with volumes from a few litres to over 10 litres, a target pH of about 7.3 to 7.6 or matching the uninjured eye, a pH recheck at least 10 minutes after irrigation stops and again 30 minutes later to confirm stability, and a rule that if pH remains abnormal after 3 litres you should suspect retained particulate matter (RVEEH 2022, Wills Eye manual, edition 8 and 9 web copies). Never neutralise an alkali with acid or the reverse. Alkalis are worse because they cause liquefactive necrosis and keep penetrating: lime, cement, wood ash lye, ammonia.

After the Fall, wood ash lye and quicklime from a kiln are the burns a village will actually see, and both are alkalis. The village has no pH paper. The usable substitute is time and volume: irrigate for 30 minutes, then rest 10 minutes, then look at whether the eye is still stinging and whether any white particles remain in the fornices, and irrigate again. Litmus from red cabbage water is a possible improvised indicator but I found no source testing it on tears and it should not be put in an eye [VERIFY].

1.6 The red eye that means sight is going

Four conditions take sight in hours or days and three of them are beyond a village. The book should teach their recognition anyway, because recognition changes what the family is told and whether a futile journey is made.

Acute angle-closure glaucoma. The triad is a painful red eye, reduced vision and a fixed mid-dilated pupil, with a hazy cornea, an eye that feels hard to the fingertip compared with the other eye, haloes around lights, headache, and nausea and vomiting prominent enough that it is mistaken for a stomach illness (RCEM Learning, RVEEH 2022, WikEM). Intraocular pressure is often above 35 mmHg. Irreversible loss can occur within hours. Hospital treatment is acetazolamide 500 mg intravenously, topical beta-blocker, pilocarpine 1 to 2 per cent (never above 4 per cent, and often ineffective until pressure falls below about 40 to 50 mmHg), then laser iridotomy. A salvaged bottle of pilocarpine or acetazolamide is worth more than its weight in anything. Without them, the village gives analgesia,

keeps the patient upright in a lit room, and accepts the loss of the eye while protecting the other one from dilating drugs and dark rooms.

Endophthalmitis, infection inside the eye, follows penetrating injury and is announced by pain out of proportion, a hypopyon and vision falling to hand movements. Reported risk after open globe injury ranges from 2.6 to 30 per cent (AAO EyeNet, emDocs). Nothing a village gives topically reaches inside the eye.

Iritis gives a deep ache, photophobia, a small or irregular pupil and redness worst at the limbus. It is treated with steroid and dilating drops, which a village will not have, and it can be confused with the two above.

Herpes simplex dendritic ulcer is the one that lay treatment actively worsens. The lesion is a branching line with terminal bulbs that stains with fluorescein. Topical corticosteroids turn a dendrite into a geographic or multifocal ulcer and have been contraindicated in epithelial herpes since the 1960s (Iowa EyeRounds atlas, Guerrero and others, case report). Aciclovir 3 per cent eye ointment five times a day is the treatment and about 99 per cent respond. The practical teaching for the Fall: **never put a salvaged steroid drop into a red eye.** The bottles look identical to antibiotic drops and the harm is blindness.

1.7 Conjunctivitis, trachoma and snow blindness

Simple infective conjunctivitis is pus, grittiness, normal vision and no pain beyond irritation. It is washed, it is given a topical antibiotic if one exists, it is reviewed in two days, and it is overwhelmingly self-limiting. The decisive finding from the Manila trial above is that povidone-iodine 1.25 per cent did as well as an antibiotic (Isenberg, abstract). A newborn aged 0 to 3 months with swollen eyes and pus is a separate emergency (gonococcal ophthalmia) requiring immediate treatment including systemic antibiotic (WHO AFRO 2018).

Trachoma is the chronic one. *Chlamydia trachomatis* transmitted by fingers, cloths and flies, repeated infection in childhood, scarring of the tarsal conjunctiva, inturned lashes, and eventually a cornea abraded blind by its own eyelashes over decades. The WHO strategy is SAFE: surgery for trichiasis, antibiotics, facial cleanliness, environmental improvement. Mass azithromycin is given where trachomatous inflammation-follicular in children aged 1 to 9 is 10 per cent or more and can stop below 5 per cent, with the elimination target for trichiasis under 0.1 per cent in adults. Where baseline TF is 30 per cent or more, five years of SAFE was not enough to reach those targets (Cameroon and Ethiopia surveys, impact reviews read through summaries).

For a post-Fall village, the F and E of SAFE are everything, because there will be no azithromycin. Clean faces on children, water for washing, latrines away from the house, and fewer flies. The S is reachable: lid surgery for trichiasis is a soft-tissue operation a trained lay healer can be taught, and epilation of the offending lashes with tweezers is the interim measure WHO's own algorithm offers when surgery is not available (WHO AFRO 2018). Epilation must be repeated every few weeks, forever, and it is better than a cornea scraped raw.

Snow blindness, photokeratitis, arc eye and the eye burned by looking at a welding flame or an eclipse are the same ultraviolet injury. Onset is delayed 6 to 12 hours, which is why the victim feels fine on the glacier and wakes at midnight with agony and a feeling of sand. It settles in 24 to 72 hours with rest from light, cool damp cloths and analgesia, and there is little else to do (NHS Scotland eyecare guidelines, AAO via Healthline). Prevention is slit goggles cut from bark, bone, leather or card, which the Inuit made for millennia, and this is one of the few places where the pre-industrial solution is simply the right one.

1.8 The eye wound and the shield

Any blow or penetrating wound with abnormal vision, or any visible break in the eyeball, is covered and treated as an open globe (WHO AFRO 2018). The rules are negative ones. No pressure on the eye, ever. No pad, no padding under the shield, no tonometry, no lid eversion, no attempt to remove a protruding object. Give analgesia and antiemetics if there are any, because straining and vomiting raise intraocular pressure, keep the head elevated,

keep the patient from eating in case of surgery, and update tetanus (AAO EyeNet, emDocs). Seidel's sign, a dark diluted stream running through a pool of concentrated fluorescein, confirms a leak, but it should not be looked for when rupture is obvious.

The shield is the one thing a village makes well. WHO's version: draw a circle about 8 cm across on thin cardboard or old X-ray film using a cup, cut it out, cut a single radial slit to the centre, form a cone, tape it, and tape it over the eye so that the rim rests on the orbital bone and nothing touches the globe (WHO AFRO 2018). An emergency text offers a polystyrene cup with the bottom cut away as the substitute, which is the same geometry (Family Medicine emergency text). An eye pad for a non-penetrating injury is cotton wool and gauze cut to an oval about 5 by 6 cm.

Prognosis is bad and should be stated honestly. Of patients with no light perception before surgery, only 15 to 20 per cent improve to light perception after it, and best outcomes follow surgery within 24 hours (emDocs, AAO EyeNet). A village has no surgery. A penetrating eye wound after the Fall means a lost eye, and the work is pain relief, prevention of infection spreading to the orbit, and protecting the remaining eye for the rest of that person's life.

Traditional eye medicine is where this goes wrong at scale. In Malawi, among 583 patients with corneal ulcers at two district hospitals, 33.8 per cent had used traditional eye medicine, and they took on average 51 days from symptom onset to presentation against 13 days for non-users, with 16 per cent against 5 per cent presenting with vision below 3/60 (Courtright and colleagues, BJO 1994, read through summary). A Nigerian teaching hospital series found complications in 54.8 per cent of traditional eye medicine users, with corneal opacity in 13.35 per cent, staphyloma in 9 per cent and corneal ulcer in 8 per cent, and 11 eyes eviscerated or enucleated. The mechanism is not mystical. It is delay plus a contaminated plant sap in an eye with a broken epithelium. The book cannot preach at this, because after the Fall the village healer *is* the traditional practitioner. The lesson to carry across is the one the Somali harm-reduction review draws: natural does not equate to sterile or safe, and a prohibition that destroys trust is worse than a rule about what may be put in an eye and what may not (Clinical Ophthalmology 2026 review, read through summary).

1.9 The ear: foreign bodies and the insect

Aural foreign bodies are overwhelmingly a problem of children and of over-enthusiastic removal. Marin and Trainor removed 80 per cent of 250 paediatric aural foreign bodies in an emergency department and referred the rest, with all batteries, sticks and rubber objects removed successfully but insects in only 65 per cent (Marin and Trainor 2006, read through summaries). The literature range across emergency departments is wide: 7 to 78 per cent success and 2 to 47 per cent complications. A tertiary paediatric series of 36 children had 53 per cent success and 47 per cent complications, split sharply by graspability: 64 per cent success and 14 per cent complications for graspable objects against 45 per cent and 70 per cent for non-graspable ones (DiMuzio and Deschler, read through summaries). A large retrospective series of 1,197 children found 68 per cent success and 35.7 per cent complications in the emergency department against 93 per cent and 5.0 per cent in the otolaryngology clinic, with beads and rocks the hardest, and **the likelihood of removal falling significantly after the first attempt** (Saint Louis University poster, not peer reviewed) [VERIFY]. Tympanic membrane rupture is quoted at 4.2 per cent of attempted removals.

Those numbers give the village its rule. **One attempt, by the best hands available, with the best light available, and then stop.** A second attempt by the same person on a crying child pushes the object past the isthmus, lacerates the canal and perforates the drum. An object in the ear canal is not an emergency unless it is a battery, which burns the canal within hours and must come out at once, or a live insect.

For the insect, the tradition and the practice agree: kill or still it first, because a scrabbling insect against the drum is unbearable and causes the patient to move. Mineral oil, cooking oil, olive oil or alcohol are the usual agents, and 2 per cent lidocaine is used where it exists, with one prehospital case report describing relief of movement-related discomfort within 20 seconds (Clinical Practice and Cases in Emergency Medicine case report, 2025). The old comparison in which lidocaine drove a cockroach out at speed while mineral oil killed it in place is an anecdote, not a trial, and later informal testing suggested lidocaine acts more slowly than oil. Insects are 14 to 18 per cent of aural foreign

bodies. The absolute rule is that **no liquid goes into an ear with a suspected perforation**, and that applies to oil as much as water.

Organic objects, beans, peas and seeds, must never be irrigated, because they swell.

1.10 Otitis media, the pain, the drum and the mastoid

Acute otitis media is the commonest severe pain in small children and the Cochrane evidence on it is unusually clean (Venekamp and others, CD000219, read through the Cochrane plain-language summary). Across 13 trials and 3,401 children with 3,938 episodes, antibiotics against placebo gave:

- **Pain at 24 hours: no benefit.** RR 0.89 (0.78 to 1.01), five trials, 1,394 children, high certainty.
- **Pain at 2 to 3 days: RR 0.71 (0.58 to 0.88), NNTB 20**, seven trials, 2,320 children, high certainty.
- Tympanic membrane perforation: RR 0.43 (0.21 to 0.89), NNTB 33.
- Contralateral acute otitis media: RR 0.49 (0.25 to 0.95), NNTB 11.
- Adverse events, vomiting, diarrhoea and rash: RR 1.38 (1.16 to 1.63), NNTH 14.
- About 60 per cent of children recover or improve by 24 hours untreated.
- Severe complications were rare and no different between groups, and the evidence is insufficient to say whether antibiotics prevent mastoiditis.

Immediate antibiotics against watchful waiting across six trials and 1,556 children: pain at 2 to 3 days RR 0.53, NNTB 8, from a single trial of 396 children at low certainty, no difference at 3 to 7 days, and adverse events NNTH 10. No serious complications in either arm.

Against mastoiditis specifically, a pooled analysis puts incidence at 0.02 per cent with RR 0.48 (0.40 to 0.59) and **NNT 5,368**, with adverse-event NNH 23 (Antibiotic treatment to prevent paediatric AOM infectious complications, 2024). A UK general practice cohort found mastoiditis at 5.62 per 10,000 AOM episodes (4.81 to 6.56), antibiotics associated with OR 0.54 (0.37 to 0.79) and NNT 2,181 (1,196 to 5,709) (Hansen and others, BJGP 2020). An earlier UK study put incidence at about 1.2 per 10,000 child-years, NNT 4,831, and noted that **most children who developed mastoiditis had never seen their general practitioner for otitis media** (Thompson and others, read through summary).

For the book, this is liberating. A village with a dwindling stock of amoxicillin should spend almost none of it on earache. Pain relief for 48 hours, warmth, upright positioning for sleep, and a look each day is correct treatment for the great majority. Antibiotics are for the child who is still febrile and in pain at 48 to 72 hours, the child under two with both ears involved, the child who looks systemically ill, and the ear that is discharging and not improving.

The mastoid is the red flag. Swelling, redness and tenderness behind the ear over the mastoid bone, with the pinna pushed forward and outward, means the infection is in the bone. Before antibiotics this was the common end of neglected otitis media and the reason cortical mastoidectomy was one of the commonest operations in Western hospitals. I could not retrieve a pre-antibiotic incidence or mortality series from a primary source despite trying the Journal of Laryngology and Otology paper, and the reviews I read say only that mastoiditis is quoted as more common in the pre-antibiotic era, with no clear figure [VERIFY]. The book should say what it knows: the proportion of children with otitis media who develop mastoiditis today, with antibiotics freely used, is about 1 in 2,000 to 1 in 5,000 episodes, the antibiotic effect on that rate is real but small, and a mastoid abscess that points through the skin can be drained by a trained hand while one that tracks inward to the meninges cannot.

Traumatic perforation of the drum, from a slap, a blast, a cotton bud or a syringe, heals by itself in most cases. Series give 94 per cent healed at 12 weeks in 53 West African patients, 91.58 per cent by two months in 202 Iranian patients, 89.75 per cent in 71 Turkish children, 81.81 per cent in 62 Baghdad patients, and 77 per cent at 12 weeks in 60 Nepali patients with 97 per cent of small perforations healed against 42 per cent of large ones. The West African study found

that large perforations, discharge, penetrating injury through the canal and **ear syringing as a wrong intervention** all significantly delayed healing. The treatment is to keep the ear dry, keep everything out of it, and wait three months.

Chronic suppurative otitis media, a perforated drum discharging for weeks, is treated worldwide by aural toilet. The Cochrane review is humbling: two studies, 351 children, 370 ears, daily dry mopping against no treatment, and at 16 weeks RR 1.01 (0.60 to 1.72) from a single study of 217 participants, very low certainty, with the authors very uncertain whether aural toileting resolves discharge at all (Cochrane CD013057). Topical antiseptics are equally unclear (CD013056, CD013055), except that topical antibiotics are likely more effective than boric acid. Dry mopping may still be the right thing: it clears mucopurulent discharge, it lets you see the drum, it costs a wick of clean cloth, and the trial evidence is too thin to rule it out. It is honest to call it Grade B for comfort and visibility and Grade D for cure.

Acute otitis externa, the swimmer's and the digger's ear, is the one ear infection where a village remedy has trial support. The Cochrane review of 19 trials and 3,382 participants found topical treatment effective and the choice of agent largely immaterial, with one high-quality trial showing acetic acid less effective than antibiotic-steroid drops at two and three weeks and symptoms lasting about two days longer (Kaushik and others, CD004740, 2010). Symptoms last about six days from the start of treatment with antibiotic-steroid drops. No trial evaluated ear cleaning. **Vinegar drops are therefore a real treatment for the first week and a poor one beyond it**, which fits a village exactly, since a week of vinegar and keeping the ear dry will settle most cases.

1.11 Wax and the syringe

Earwax is not a disease. It is a disease only when it is total and the patient is deaf or when it hides a drum you need to see. Softening with warm oil for several days and letting it come out is safe. Syringing is where the harm lives.

Reported perforation rates are low but real: 0.2 per cent of 622 patients in a Nigerian cohort (Ogunleye and Awobem), about 1 in 1,000 ears syringed producing a complication needing specialist referral in UK general practice, and an overall complication estimate of about 0.1 per cent in a Community Ear and Hearing Health review calling it safe in trained hands. Other complications are canal laceration, otitis externa, vertigo and failure. Severe injuries have followed the use of dental oral jet irrigators with the wrong tip.

The contraindications matter more than the rate: any perforation past or present, a grommet, previous middle ear or mastoid surgery, active otitis externa or media, recent trauma, a foreign body in the canal, vertigo, radiotherapy to the area, cerebrospinal fluid discharge, and an only hearing ear. **The commonest fatal-to-hearing error a village healer will make is to syringe an ear that is deaf and discharging because the drum is already perforated.** Water driven into a middle ear infects it. The rule for the book: never syringe an ear that has ever discharged, and never syringe without first asking whether the ear has ever run.

1.12 The toothache and its causes

Toothache is not one thing and the treatment differs completely.

- **Sensitivity to cold that stops within seconds** is dentine exposed by a cavity or a receding gum. Reversible. Clean it, keep sugar off it, and it settles.
- **Lingering pain after cold or heat, pain that wakes the patient at night, pain the patient cannot localise to one tooth** is irreversible pulpitis. The nerve is dying. Nothing short of removing the pulp or the tooth cures it.
- **Pain on biting and on tapping the tooth, a tooth that feels long and slightly loose, a bubble on the gum near the root tip, swelling of gum or face on that side** is an apical abscess (Hesperian, *Where There Is No Dentist*, Tooth Abscess page). The pulp is dead and the infection is in the bone.
- **Pain in a young adult behind the last lower molar with swelling, bad taste and difficulty opening the mouth** is pericoronitis around an erupting wisdom tooth, and it is the commonest starting point for a

spreading infection in the mandible.

- **Deep steady pain two to four days after an extraction, with bare bone visible in the socket and a foul smell** is dry socket.

The lay healer's triage is: can it be cleaned and watched, must it be drained, or must it come out. Analgesia for all of them is covered in WO-11, where clove held against the tooth has one trial behind it and clove oil is a poison when swallowed (THRIVING library, WO-11).

1.13 The dental abscess and its drainage

The rule from WO-14 applies in the mouth as everywhere: where there is pus, let it out (THRIVING library, WO-14). The Cochrane review of systemic antibiotics for symptomatic apical periodontitis and acute apical abscess found three trials and 134 participants and, critically, **no trial comparing an antibiotic against placebo without a surgical intervention**, with very low certainty throughout (Cope and others, CD010136.pub4, 2024). The guideline position, and the one the book should take, is BMJ Best Practice's: operative treatment is the cornerstone, and antibiotic therapy alone may slow a mild odontogenic infection but it returns once the antibiotic stops unless the source is treated.

Hesperian's method is simple and correct: if possible open the abscess with a sharp sterile knife to release the pus, or draw the pus off with a sterile syringe and needle, and cover the wound with a sterile dressing. If it cannot be drained, reduce the swelling with warm cloths on the face and warm water rinses in the mouth many times a day until it goes down (Hesperian, Tooth Abscess). Note that Hesperian says salt is not necessary in those rinses, where HY-12 and the extraction literature both use warm salt water. Either is fine. The heat and the frequency are what matter.

Drainage is not cure. A dead pulp keeps reinfecting. Either the tooth comes out or, at a district with a lay healer trained in it, the pulp chamber is opened to drain through the crown and later filled. Pulp extirpation without radiographs, files or irrigant is beyond a village.

Hesperian's antibiotic for an abscess is amoxicillin first line, ampicillin as substitute, erythromycin for the penicillin-allergic, with the course finished even if the tooth comes out. The adult and older child dose given is 1 g twice a day, and erythromycin 500 mg four times a day in adults for 7 to 10 days. I read these from the Hesperian web page and the dose table extracted imperfectly, so the age bands should be checked against the printed book before being reprinted [VERIFY, age-to-dose pairings]. IN-05 in this library lists metronidazole 500 mg every 8 hours as the WHO Access drug for dental abscess and anaerobes (THRIVING library, HY-12 citing IN-05), and metronidazole plus amoxicillin is the combination for a foul anaerobic facial infection.

1.14 The extraction: history, instrument and technique

Tooth-pulling is the oldest surgical trade in the world and it was for most of its history a street performance. Medieval and early modern extraction was barbers' work, aimed at relieving pain rather than preserving anything, and the signature instrument was the pelican, named for its beak, credited to Guy de Chauliac in the fourteenth century, which levered the crown out sideways against the adjacent teeth and gum. The dental key, a shaft with a claw rotating about a bolster, displaced the pelican in the eighteenth century and was itself less destructive if used skilfully, which it usually was not. Pierre Fauchard (1678 to 1761) published *Le Chirurgien Dentiste* in 1728, separated the dentist from the barber-surgeon, adapted instruments from watchmakers and jewellers, and padded the bolster of his pelican with skin or rag to protect the gum. Purpose-shaped forceps, matched to the anatomy of each tooth, came with John Tomes in the mid-nineteenth century and are what a modern extraction uses (Wikipedia, Pierre Fauchard, PMC biography of Fauchard, Bath Medical Museum, Hungarian history of dentistry paper). The lesson for the Fall is that **the forceps is a nineteenth-century idea and a forge can make it.** The key and the pelican are what a village gets if its smith copies a picture from before 1800, and both of them break more teeth and tear more gum than the forceps that replaced them.

Dickson's kit in *Where There Is No Dentist* is four instruments: a spoon or probe, a straight elevator, a number 150 upper universal forceps and a number 151 lower universal forceps. Useful additions are 87 lower molar cowhorn forceps, 73 lower molar hawk's bill, 18R and 18L upper molar forceps, and Cryer 30 and 31 curved elevators for broken roots (Hesperian, The Instruments You Need).

The technique, as Hesperian gives it, is the protocol this book should print, and it is given as Protocol 6 below. Its key points, which are the points a smith and a healer must both understand:

1. Anaesthetise, wait about 5 minutes, and **test that the tooth is numb before starting**.
2. Separate the attached gum from the tooth all the way round, on both the cheek side and the tongue side, going only as deep as the attachment.
3. Loosen with the elevator held with a finger resting on bone, **never levering against the good tooth next door**, with the blade between the target tooth and the tooth in front and the curved face against the target.
4. Place the forceps as high up the root as possible under the gum, not low on the crown, because a grip on the crown breaks the crown.
5. Support the surrounding bone with the other hand, and feel the bone widen as the tooth loosens.
6. **One root means turn the tooth. Two or three roots mean tip it back and forth, as if loosening a fence post, increasing the movement gradually.** Front teeth come straight out. Back teeth usually come towards the cheek, and some lower molars come towards the tongue.
7. Work slowly. Squeezing too hard or hurrying breaks the tooth.
8. Examine the extracted tooth for missing root tips.
9. Press the sides of the socket back together, lay gauze over it, and have the patient bite firmly for **30 minutes, or 2 hours in a child**.

Anaesthesia is where village extraction most often fails and WO-11 should be read with this section. Upper teeth numb reliably by infiltration because the bone is thin. Lower back teeth need an inferior alveolar nerve block, and in an inflamed tooth that block fails often. Reported failure rates in symptomatic irreversible pulpitis run from 30 to 80 per cent, with one series finding 71.7 per cent failure after a single mepivacaine block. Supplementary injections rescue it: in Kanaa's trial, buccal infiltration after a failed block succeeded 84 per cent, intraosseous 68 per cent, intraligamentary 48 per cent and a repeat block 32 per cent, and a four-arm trial found a block alone 40 per cent, block plus intraosseous 92.5 per cent, block plus intraligamentary 72.5 per cent and block plus buccal infiltration 65 per cent (read through summaries and a trial protocol document) [VERIFY, protocol document not peer reviewed]. **The practical teaching: after a failed lower block, add a buccal infiltration beside the tooth rather than repeating the block.**

1.15 When the extraction goes wrong

The broken root. This is the commonest accident. A Brazilian teaching clinic found root fracture the single most frequent accident at 6.45 per cent of permanent-tooth extractions. A Turkish series of 186 extractions by intern students had a 20.43 per cent overall complication rate, of which crown fracture was 42.1 per cent, apical-third root fracture 31.58 per cent and two-thirds root fracture 26.32 per cent, with root-tip curvature and root separation the strongest predictors. A student clinic in Bandung reported complications in 64 per cent of cases, root fracture making up 41.43 per cent of them. All of these are student series, which is exactly the right comparison for a lay healer. **Expect to break a root in roughly one extraction in fifteen when you are trained, and one in three when you are learning.**

Hesperian's handling is sound and conservative: retrieve a visible root with an elevator if you can, and leave a small deep fragment alone, because it is better left in the socket and it usually loosens in about a week (Hesperian, Problems That Can Occur). Digging blindly for a root tip destroys more bone than the fragment ever will.

The root in the sinus. Upper premolar and molar roots can sit within a millimetre of the maxillary sinus floor.

Oroantral communication is reported at 0.31 to 4.8 per cent of maxillary extractions in a systematic review, with 48 to 92.6 per cent of cases from premolars and molars, and a single Polish centre reported 10.07 per cent after upper first molar extractions in 970 cases. An opening under 5 mm in a healthy sinus often closes over a clot. One over 5 mm needs surgical closure, and an opening not closed within 48 to 72 hours epithelialises into a permanent fistula. Hesperian's instruction when a root goes into the sinus is the right one for a village: **do not search for it, cover the socket with gauze, tell the patient not to blow the nose, and refer.** After the Fall, "refer" means the district infirmary, and if there is none, it means accepting the fragment and treating the sinusitis that may follow.

Bleeding. Hesperian: more gauze, wait 5 minutes, and if it continues, place a suture across the socket. A thread drawn across the socket and tied compresses the gum margins and works. Topical tranexamic acid, which is where a modern clinic would go, is less impressive than it sounds: in EXTRACT-NOAC, 222 patients on direct oral anti-coagulants randomised to 10 per cent tranexamic acid mouthwash or placebo had post-extraction bleeding in 26.4 against 28.6 per cent, RR 0.92 (0.60 to 1.42), with a non-significant reduction in total bleeds (46 against 85, RR 0.57, 0.31 to 1.05) and fewer unplanned medical contacts (RR 0.39, 0.16 to 0.98) (Ockerman and others, PLoS Medicine 2021). Pressure and a suture are not a poor substitute for tranexamic acid. They are the main treatment.

Dry socket. Incidence is 1 to 5 per cent of routine extractions and 1 to 37 per cent of third molars depending on definition. Smoking roughly triples it: pooled prevalence 13.2 per cent (5.8 to 23.1) in smokers against 3.8 per cent (2.1 to 6.0) in non-smokers. Oral contraceptives raise it (RR 1.80, 1.33 to 2.43). The most consistently reported predictors across 24 studies were age, previous infection at the site and difficulty of the extraction. Treatment evidence is weak and conflicting. Zinc oxide and eugenol dressing gave initial pain relief at 26.04 ± 3.82 minutes against 6.81 ± 2.25 minutes for a proprietary alternative and final relief at 8.78 ± 0.24 days against 6.88 ± 0.64 days in one trial of 60 patients. A double-blind trial of 90 patients found honey and zinc oxide eugenol both gave significant immediate pain reduction while the control group had pain for over a week. A Nepali comparison of 42 patients found that daily zinc-oxide dressing changes required two or more visits in 19 of 21 patients, while debriding the socket and suturing the margins settled 19 of 21 in a single procedure.

So the village protocol is: irrigate gently, dress with something that carries eugenol and sticks, which means **a paste of ground clove in a little honey or oil on a small cotton pledget**, change it when the pain returns, and consider debriding and suturing the socket margins if two changes have not worked. HY-12's finding stands: two warm salt rinses a day after an extraction reduce dry socket as much as six do (THRIVING library, HY-12). Honey as a socket dressing has one small randomised trial behind it and clove is the traditional eugenol source, so this is Grade B for pain and Grade C for the formulation.

The wrong tooth. This is real, it is common, and it is almost entirely preventable. NHS England recorded 33, 46, 34 and 42 wrong-tooth extractions a year between April 2015 and April 2019, up to 10 per cent of all preventable dental never events, despite mandatory reporting, and the category was removed from the never events list on 1 April 2021. Self-report surveys of dentists find much higher lifetime rates: 14 per cent of 351 Saudi dentists, 13 per cent of Nigerian respondents, 21.1 per cent in a four-clinic survey. A Taiwanese university hospital measured annual erroneous extraction rates of 0.026, 0.025 and 0.046 per cent between 1996 and 1998, and **after an educational programme recorded no wrong-site extraction at all between 1999 and 2001**. That last figure is the one to print. The error is a checking failure and checking fixes it.

1.16 Ludwig's angina, the infection that kills

Wilhelm Friedrich von Ludwig described it in 1836 as a rapidly and frequently fatal gangrenous cellulitis of the neck and floor of the mouth. It is a severe diffuse cellulitis of acute onset and rapid spread involving the submandibular, sublingual and submental spaces **bilaterally**, and the majority of cases are odontogenic, mainly from second and third lower molars whose roots pass below the mylohyoid line so that pus escapes into the submandibular space rather than into the mouth (Candamourty and others 2012). Pre-antibiotic mortality is repeatedly quoted as exceeding 50 per cent, citing Bansal (2003) and Britt (2000), and one teaching source gives 60 per cent. Modern mortality is about 8

per cent, or under 10. I could not trace the 50 per cent figure to an original pre-1940 case series despite trying, and the book should say so [VERIFY].

The signs, in the order they arrive: a lower back tooth that has ached for days, then swelling under the jaw on both sides that is hard and board-like rather than soft and fluctuant, then inability to open the mouth, then the tongue pushed up and back, then drooling because the patient cannot swallow their own saliva, then a muffled voice, then stridor. **Stridor means the airway is closing.** Other warning signs of a spreading odontogenic infection are swelling that crosses the midline, dysphagia, dysphonia, torticollis, and fever with rapidly rising swelling.

What kills is obstruction, not sepsis, and what saves is an airway. The hospital answer is an elective awake tracheostomy before obstruction, with blind nasotracheal intubation specifically avoided because it can rupture the abscess or bleed. A village cannot do a tracheostomy safely and should not be told it can. What a village can do, in order: get the source tooth out or drained at the first sign of submandibular swelling, before trismus sets in and makes extraction impossible. Give every antibiotic it has, amoxicillin plus metronidazole being the right pair for mixed anaerobic mouth flora. Sit the patient bolt upright and never lay them flat. Keep them taking sips while they still can. If the district has anyone who has ever cut an airway, send for them on day one rather than day three. Once stridor has started, a village without a surgical airway is watching a death, and the honest work is morphine if there is any, an upright position, company and the truth.

Other spread patterns to name: cavernous sinus thrombosis from an upper tooth via the angular and ophthalmic veins, announced by fever, a protruding eye and gross periorbital swelling, which the brief's eye section and this one meet at, orbital abscess, mediastinitis down the fascial planes of the neck, and osteomyelitis of the jaw, covered in WO-14 (THRIVING library, WO-14).

1.17 The broken tooth, the knocked-out tooth and the broken jaw

A fractured crown with no pulp exposed needs smoothing and watching. A fracture with a red bleeding point in the middle, an exposed pulp, will become an abscess within weeks unless the pulp is removed, and in a village that means extraction eventually.

An avulsed permanent tooth is the one dental emergency where minutes count. The IADT 2020 guidance, read through secondary summaries because I could not reach the original: replant as soon as possible, ideally within 15 minutes. Do not rinse with water, use milk or saline. After 60 minutes of dry time all periodontal ligament cells are non-viable. Splint for two weeks (IADT 2020 via secondary summaries) [VERIFY, original guideline not read]. A retrospective study of 62 replanted teeth found 50 per cent still in place at five years and 71 per cent of the lost teeth had an extra-alveolar time over an hour. The village version: pick the tooth up by the crown, never the root, put it straight back in the socket if you can bear to, hold it there with a finger or a bitten cloth, and if you cannot, carry it in milk or in the patient's own saliva inside their cheek. Never scrub it. A deciduous tooth is never replanted, because it damages the permanent tooth forming above.

A fractured mandible gives a step in the bite, an inability to close the teeth together properly, numbness of the lower lip, bleeding at the gum line between two teeth and pain on moving the jaw. Low-resource series show closed reduction remains the backbone: a Nigerian teaching hospital used closed reduction and immobilisation in 53.10 per cent of cases and wire osteosynthesis in 34.51 per cent, concluding the relevance of wire and maxillomandibular fixation in a resource-poor setting cannot be underestimated, and a Ghanaian series of 268 patients over 2010 to 2019 concluded closed reduction with indirect fixation could successfully manage mandibular fractures in low-resourced facilities. A biomechanical study found figure-of-eight interosseous wiring resists comparable forces to plating, suggesting it as the fallback where plates do not exist (Gadkaree and others). Bridle wiring, a wire looped around the necks of the teeth on either side of the fracture, is a temporising measure described in paediatric cases with two weeks of immobilisation against four to six in adults.

For the book: a village can wire a jaw shut, using soft wire or even strong thread around the teeth, after setting the

bite by feel against the patient's own memory of how their teeth met. Four to six weeks of liquid food follows, and wire cutters must hang beside the bed in case of vomiting. That is a district-level skill taught to a village healer, not a first-week one.

1.18 What can be made and what cannot

Makeable, by a competent forge and a patient hand: extraction forceps on the Tomes pattern, straight and curved elevators, a periosteal elevator, a dental probe and mirror, a syringe, a mouth prop, tweezers for epilating lashes, an eye shield of card or bark, slit goggles against snow, an irrigation vessel, a cotton bud, and wire for a jaw.

Not makeable, and therefore to be hoarded: natamycin and any antifungal, chloramphenicol and any antibiotic eye preparation, aciclovir, acetazolamide, pilocarpine, fluorescein strips, local anaesthetic, azithromycin, and glass ionomer cement.

One restoration technology deserves naming because it is the one thing that keeps a tooth. Atraumatic restorative treatment removes soft decay with hand instruments alone, no drill and no electricity, and fills the cavity with high-viscosity glass ionomer. Pooled survival in the 2018 update was 94.3 per cent (± 1.5) for single-surface restorations in primary posterior teeth over two years and 87.1 per cent (± 3.2) in permanent posterior teeth over three years, falling to 65.4 per cent (± 3.9) and 77 per cent (± 9.0) for multiple-surface restorations (de Amorim and others 2018, earlier pooled figures de Amorim, Leal and Frencken 2012). Frencken's 2014 summary notes no difference between single-surface glass ionomer ART restorations and amalgam. **The technique survives the Fall and the material does not.** A stock of glass ionomer powder and liquid, kept dry, is the second most valuable dental salvage after silver diamine fluoride (THRIVING library, HY-12).

2. Evidence grades

Practice	Tradition says	Record shows	Grade
Irrigation of chemical eye burn, 30 min, copious	Wash it out	Universal practice, no RCT, pathophysiology decisive	B
Antibiotic ointment on fresh corneal abrasion	Prevents the ulcer	Bhaktapur 96% healed, none ulcerated under 18 h, VIEW RCT null (IRR 1.03)	B downgraded to C
Daily inspection of an injured eye	Watch it	No trial, but the only step both studies support	C
Povidone-iodine 1.25% for bacterial keratitis	Antiseptic	172 patients, 54% vs 52% antibiotic cure	B
Povidone-iodine 1.25% for bacterial conjunctivitis	Antiseptic	459 children, equal to antibiotic	A
Natamycin 5% for filamentous fungal ulcer	n/a	MUTT I, 323 patients, better vision and fewer perforations than voriconazole	A
Honey drops on a corneal ulcer	Heals the eye	18 uncontrolled cases, one 45-eye comparison, one Acanthamoeba case after use	D

Practice	Tradition says	Record shows	Grade
Patching a corneal abrasion	Rests the eye	Cochrane: no faster healing, possibly more pain	X for healing
Topical steroid in a red eye by a lay healer	Soothes	Geographic ulcer, perforation in HSV	X
Rigid shield, no pressure, for open globe	Protect it	Universal, mechanism certain	B
Slit goggles against snow blindness	Inuit, Sami, Alpine	Millennia of use, UV physics	C
Face washing and latrines against trachoma	SAFE	Programme evidence, large and consistent	B
Epilation of trichiatic lashes	Pull the lash	WHO interim option where surgery unavailable	C
One attempt only at an aural foreign body	n/a	Success falls and complications rise after attempt one	B
Oil or lidocaine to still an insect in the ear	Drown it	Case reports and anecdote only	D
Antibiotics for acute otitis media	Cures earache	No effect at 24 h, NNTB 20 at 2 to 3 days, NNTH 14	A
Antibiotics to prevent mastoiditis	Prevents it	NNT 2,181 to 5,368	A, but futile at village scale
Dry mopping for chronic discharge	Clean the ear	RR 1.01 at 16 weeks, very low certainty	B comfort, D cure
Vinegar (acetic acid) drops for otitis externa	Sour the ear	Effective short term, worse than antibiotic-steroid beyond a week	A short term
Ear syringing an undiagnosed ear	Clears it	0.1 to 0.2% complications, drives water into a perforated middle ear	X without otoscopy
Drainage of a dental abscess	Let the pus out	Guideline cornerstone, no trial of antibiotic alone without surgery	B
Extraction under local anaesthetic by trained lay healer	Pull it	Student series: 6 to 20% complications, almost all recoverable	B
Buccal infiltration after a failed lower block	n/a	84% rescue vs 32% repeat block	A
Leaving a small deep broken root	Leave it be	Hesperian, loosens in about a week	C
Pressure plus a suture for socket bleeding	Press it	Standard, and tranexamic mouthwash adds little (RR 0.92)	B
Clove or honey dressing for dry socket	Clove for toothache	Honey vs ZOE RCT, 90 patients, both beat control	B pain, C formulation

Practice	Tradition says	Record shows	Grade
Two warm salt rinses a day after extraction	Salt heals	As good as six (THRIVING library, HY-12)	B
Checking the tooth three times before pulling	n/a	Taiwan: wrong-site extraction to zero after education	B
Replanting an avulsed tooth within 15 minutes	Put it back	50% survival at 5 years, 71% of failures had over 1 h dry time	B
Closed reduction and wiring of a jaw	Tie it shut	Majority treatment in African series, acceptable outcomes	B
Atraumatic restorative treatment	n/a	94.3% single-surface survival at 2 years, primary teeth	A
Traditional plant saps into an injured eye	Heals the eye	54.8% complication rate in one series, 51 vs 13 days to presentation in another	X
Couching for cataract	Removes the veil	42.7% of Nigerian cataract procedures, 73% of those eyes blind	X

3. Means ledger

Rung	Eye	Ear	Tooth and jaw	What it changes
Hands and knowledge	Lid eversion, removing a surface foreign body with a wet cloth corner, immediate water irrigation of a burn, shielding a wound with cupped card, shading the eyes against snow, daily inspection, honest prognosis	Not putting anything in the ear, one careful look, upright sleep for earache, keeping a discharging ear dry, never syringing an ear that has run	Warm rinses, pressure with cloth on a bleeding socket, holding a knocked-out tooth in the cheek, triage of the five toothaches, recognising Ludwig's	Prevents perhaps half of all permanent damage. The whole rung is restraint

Rung	Eye	Ear	Tooth and jaw	What it changes
The hearth (fire, clean water, salt, honey, fat, cloth, needle, knife)	30 minutes of boiled-cooled irrigation, salt-water lid washing, card cone shield, cotton bud, warm compress 5 to 10 min, clean cloth pads	Warm oil to soften wax, vinegar drops for otitis externa, dry mopping with a twist of clean cloth, oil to still an insect	Clove pledget in honey for dry socket, incision of a pointing gum abscess with a sterilised knife, warm compresses, gauze bite 30 min, thread suture across a socket	Turns a burn into a scar instead of a blind eye, and an abscess into a drained abscess
Garden and still (hamlet, ethanol, beeswax, soap, scale, pressure cooker, forge)	Sterilised fine needle for a superficial corneal foreign body, honey drop as a last resort, slit goggles, a magnifying lens	Sterilised wicks and probes, alcohol-vinegar drops, a proper ear speculum	Forged forceps 150 and 151, straight and Cryer elevators, probe and mirror, sterilised instruments, a mouth prop, a syringe for anaesthetic	The extraction becomes possible. This is the rung where the chapter's main operation arrives
Village dispensary (300, trained lay healer, salvaged stock, instruments, microscope)	Salvaged chloramphenicol or povidone-iodine, diluted PVI 1.25%, fluorescein if any, a trained eye for the hypopyon, a register of every eye injury	Otoscope, correct syringing with contraindications known, Gram stain of discharge	Routine extraction under infiltration or block, abscess drainage and antibiotic, dry socket care, bridle wiring, ART fillings while cement lasts	Mortality from facial infection falls sharply. Most teeth that must come out, come out
District infirmary (3,000, nurse or doctor, sterile room, ten beds, lab bench)	Lid surgery for trichiasis, suture of a lid laceration, enucleation of a blind painful eye, acetazolamide and pilocarpine if stocked	Mastoid abscess drainage where it points, myringotomy, management of chronic discharge	Surgical extraction with a flap, closure of an oroantral communication, incision and drainage of submandibular space, surgical airway, maxillomandibular fixation	The Ludwig's patient has a chance. A surgical airway is the single intervention that converts a death into a recovery
Hospital before the Fall	Slit lamp, corneal scrape and culture, natamycin, intravitreal antibiotic, corneal graft	CT, cortical mastoidectomy, tympanoplasty	Radiographs, elective tracheostomy, plate fixation, endodontics, implants	Reference only. The gap is widest for the fungal ulcer and the deep neck infection

4. Harm test

Eye irrigation. Harms by force and by the wrong fluid. Pouring from a height drives particles deeper. Any irrigation of an eye with a suspected penetrating wound expels the contents. Never irrigate an eye that is leaking. Signs it is going wrong: a pupil that is no longer round, a dark fleck on the white that was not there, vision that falls during the procedure. Stop, shield, and do not touch it again.

Lid eversion and foreign body removal. The error is everting a lid over a thinned or perforated cornea, or digging at a corneal object with an unsteady hand. One slip across the visual axis is a lifetime of blurred central vision. Never attempt a corneal foreign body in a frightened child, an uncooperative adult or poor light.

Povidone-iodine at the wrong strength. 10 per cent surgical solution in an eye is a chemical burn of the cornea. The trial concentration is 1.25 per cent, an eightfold dilution, and the dilution must be made by someone who can measure. A healer who guesses will blind someone. Iodine in a neonate and in anyone with thyroid disease is a further caution.

Honey in an eye. Raw honey is not sterile. The documented harm is *Acanthamoeba* keratitis, which is far worse than the ulcer it was put in for.

Salvaged steroid drops. The worst single item in a salvaged pharmacy. They turn a herpes dendrite geographic, convert a fungal ulcer into a perforation and raise pressure in a predisposed eye. Who must never receive them: anyone, from a lay healer's hand.

Aural foreign body removal. Harms by repetition. Repeated attempts push the object past the narrow isthmus, tear the canal and perforate the drum at about 4 per cent. Who must never be attempted in a village: a child under five with a smooth round bead, where even hospitals succeed less than half the time.

Ear syringing. Harms by water pressure into a middle ear behind a perforation the healer did not know about, by canal laceration, and by severe vertigo if the water is cold. The error that harms is syringing without asking whether the ear has ever discharged. Signs: sudden vertigo and vomiting during the procedure, or blood. Stop at once, keep the ear dry, and expect the drum to heal over about 12 weeks.

Antibiotics for earache. The harm is 1 adverse event in every 14 children treated, and the exhaustion of a village's stock on a condition where 60 per cent are better in 24 hours untreated.

Dental local anaesthetic. The full harm test is in WO-11. The ceiling is the lesser of 3 mg/kg and 200 mg of plain lidocaine, and the commonest practical errors are cutting before 10 minutes and repeating a failed lower block rather than adding an infiltration.

The extraction. How it maims: the wrong tooth, which is irreversible, a fractured maxillary tuberosity from excessive force on an upper molar, a root driven into the maxillary sinus, a dislocated jaw from unsupported pressure on the mandible, a fractured mandible in an atrophic elderly jaw, and bleeding in a patient nobody knew was a bleeder. Who must never be extracted in a village: the patient with trismus and bilateral submandibular swelling, because they need an airway, not a tooth socket, the patient with uncontrolled bleeding from a previous small cut, the patient in whom the healer cannot identify the tooth with certainty. Pregnancy is not a contraindication to extraction, and a dental infection in pregnancy is far more dangerous than the procedure. Signs it is going wrong: the crown crumbling, the bone moving as a block rather than flexing, air bubbling from the socket when the patient blows gently through the nose with the nostrils pinched (which is an oroantral communication), and a patient who cannot now close their mouth (a dislocation).

Historical cases of harm. The couching record is the clearest: in the Nigerian national blindness survey of 2005 to 2007, 42.7 per cent of 583 eyes that had undergone a procedure for cataract had been couched, and 73 per cent of those eyes were blind. The traditional eye medicine record is the second: 54.8 per cent complications in one Nigerian

teaching hospital series with 11 eyes removed. Both are recent, both come from societies with a healer and no surgeon, and both are what this book is trying to prevent being reinvented.

5. Red flags

Signs that mean sight, hearing or life is going and the village cannot give what is needed.

1. **A white or grey patch in the black of the eye, with pain and falling vision.** A corneal ulcer. Without an antibiotic or antifungal it perforates. Do anyway: cover from light, no rubbing, no traditional preparation, no patch, analgesia, povidone-iodine 1.25 per cent if it exists, and tell the family the eye will probably be lost but the other one need not be.
2. **A painful red eye with a fixed mid-dilated pupil and a hard globe.** Angle closure. Hours to blindness. Do anyway: analgesia, upright in a lit room, and never a dilating drug in the other eye.
3. **A pupil that is no longer round, or dark tissue on the white.** Open globe. Shield, no pressure, no food, antibiotic if any, and comfort.
4. **Pus or a level of white fluid in the front of the eye.** Infection inside. Nothing topical reaches it.
5. **A chemical burn where the white of the eye has gone pale rather than red.** Blanching means the vessels are destroyed. Irrigate anyway, longer than you think.
6. **Swelling, redness and tenderness behind the ear with the ear pushed forward.** Mastoiditis. Drain it if it points to the skin, give everything you have, and accept that inward spread is beyond you.
7. **A discharging ear with facial weakness, severe headache, neck stiffness or drowsiness.** The infection is intracranial.
8. **Bilateral hard swelling under the jaw, tongue pushed up, drooling, trismus, a muffled voice.** Ludwig's angina. Before stridor: drain or extract the source and give everything. After stridor: only a surgical airway saves them. Do anyway: upright, morphine if any, and the truth.
9. **Facial swelling spreading up towards the eye, with a protruding eye and fever.** Infection tracking to the cavernous sinus.
10. **A knocked-out adult tooth dry for over an hour.** Replant anyway, because half still last five years, but expect loss.
11. **Trismus so severe the mouth will not open two fingers' width.** You cannot now treat the tooth that caused it. The infection is already in the muscles.

6. The case against

Against teaching lay extraction at all. The strongest critic is the record itself. Student series report complication rates from 6.45 per cent to 64 per cent, wrong-tooth extraction is still a never event in the health system that invented the term, and extraction without radiographs breaks roots routinely. A critic would say that teaching a villager to pull teeth produces fractured tuberosities, roots in sinuses and dead pulps left behind, and that the book should teach drainage, analgesia and prevention and stop there. The answer is that the alternative is not a dentist. It is a man with pliers and an uncle holding him down, which is the historical baseline that the pelican and the key represent. A written technique, four instruments and a checking ritual are a large improvement over that, and the complication that worries the critic most, the wrong tooth, is the one that an educational programme in Taiwan abolished entirely.

Against the eye chapter. The named critics here are the authors of the VIEW trial themselves, who tested the most attractive idea in community ophthalmology and found nothing (O'Brien and others). Kara-José and others have long argued that community eye programmes measure activity rather than outcome. And the task-shifting study in African eye clinics found the standard primary signs too insensitive and non-specific to guide referral. A fair critic says that lay eye care produces false confidence, delays, and the illusion that something is being done. The honest reply is to narrow the claims: wash chemical burns, shield wounds, remove surface foreign bodies, look every day, and never put anything else in an eye. That list is defensible. "Village eye care" as a programme is not.

Against the antibiotic restraint in this report. A critic would say that the Cochrane earache numbers come from high-income countries with good nutrition and that a malnourished child after the Fall is closer to the pre-antibiotic population, where mastoiditis and intracranial spread were real. That is probably right, and the review itself notes the evidence is insufficient on rare complications. The compromise in the protocols below is a 48-hour rule and a lower threshold for children under two and for children who are visibly ill.

Against the romance in both directions. The herbal romance here is honey in the eye, which has 18 uncontrolled cases and one *Acanthamoeba* keratitis behind it. The hospital romance is the belief that a salvaged drug bottle equals a hospital: povidone-iodine needed hourly instillation around the clock for three days in hospitalised patients to match an antibiotic, and natamycin needs a fermentation plant. Neither romance survives the numbers.

7. Ten-line summary

1. Daily inspection of an injured eye is the only eye intervention supported by both the Bhaktapur series and the VIEW trial that refuted it.
2. Bhaktapur: 96 per cent of 442 treated abrasions healed, none of 284 treated within 18 hours ulcerated, but the randomised VIEW trial found no reduction in ulcers at all (IRR 1.03).
3. Chemical eye burns need at least 30 minutes of copious irrigation with clean water, started before anything else is checked, and alkalis are worse than acids.
4. Povidone-iodine 1.25 per cent cured bacterial keratitis in 54 per cent against 52 per cent for antibiotic, and equalled antibiotic in 459 children with conjunctivitis.
5. Fungal keratitis after plant injury is the farmer's blindness, 20 to 60 per cent of tropical culture-positive ulcers, and nothing a village can make treats it.
6. Antibiotics do nothing for earache at 24 hours, help 1 child in 20 at 2 to 3 days, and harm 1 in 14.
7. Mastoiditis needs 2,000 to 5,000 children treated to prevent one case, so a village should spend its antibiotic elsewhere.
8. One attempt at an ear foreign body, by the best hands present: success falls and complications rise after the first try, and the drum perforates in about 4 per cent.
9. Extraction is four instruments and nine steps, and the commonest accident, a broken root, is usually best left alone.
10. Ludwig's angina is bilateral hard submandibular swelling with a raised tongue and drooling, killed more than half before antibiotics, and is survivable only if the source tooth is dealt with before trismus and stridor arrive.

8. Open questions

- **Does prompt antibiotic ointment on a fresh corneal abrasion prevent ulceration?** Bhaktapur says dramatically yes, VIEW says no at programme level, and nobody has run an individually randomised trial of ointment against no ointment within 18 hours.
- **Does a village-made dilution of povidone-iodine work in an eye?** The trials used a pharmaceutical 1.25 per cent preparation. Nobody has tested an eightfold dilution of a surgical stock in boiled water for tolerability, let alone efficacy.
- **What is the real pre-antibiotic mortality of Ludwig's angina?** Every source says over 50 per cent and every source cites a review rather than a series. The same problem as noma's 90 per cent in HY-12.
- **What was the pre-antibiotic rate of mastoiditis after acute otitis media?** I could not reach a primary series. This matters, because it is the number that tells a village how much antibiotic restraint costs.
- **Does dry mopping do anything for chronic ear discharge?** Cochrane says RR 1.01 and very low certainty, against a worldwide practice.
- **What is a trained lay healer's complication rate at extraction after fifty supervised cases?** All the series I found are students in teaching hospitals with radiographs. Nobody has measured the Hesperian-trained worker.

- **Is clove in honey an effective dry socket dressing?** Honey has one trial and clove is the traditional eugenol source, but the combination has never been tested.

9. Sources to read in full

1. **Upadhyay MP and others (2001)**, the Bhaktapur eye study, *British Journal of Ophthalmology* 85(4):388-392. Read it with the VIEW trial beside it.
2. **O'Brien KS and others**, the Village Integrated Eye Workers (VIEW) cluster-randomised trial. The refutation, and the reason the book must be careful.
3. **WHO AFRO (2018), *Primary Eye Care Training Manual*.** The algorithms, the irrigation protocol, the shield. The closest thing to this chapter already written.
4. **Dickson M, *Where There Is No Dentist*, Hesperian.** Chapters 9 to 12. The extraction technique the book should print, with attribution.
5. **Prajna NV and others (2013)**, the Mycotic Ulcer Treatment Trial I, *JAMA Ophthalmology*. For what treatment of a fungal ulcer is worth, and what is lost without it.
6. **Venekamp RP and others, Cochrane CD000219**, antibiotics for acute otitis media. The numbers that free a village's antibiotic stock.
7. **Isenberg SJ and others (2017)**, povidone-iodine 1.25 per cent for bacterial keratitis, *American Journal of Ophthalmology*. The most salvageable idea here.
8. **Candamourty R and others (2012)**, Ludwig's angina, *Journal of Natural Science, Biology and Medicine*. Short, and the airway argument is what a healer must know.
9. **de Amorim RG and others (2018)**, ART survival meta-analysis, *Clinical Oral Investigations*. Hand instruments and cement, 94 per cent at two years.

At the bedside after the Fall

For a household. Four rules and one object. The rules: water into a burned eye at once and for half an hour, nothing ever put into an ear, one careful look at a foreign body and then stop, and a swelling under the jaw on both sides is a journey to be started today, not tomorrow. The object: a card cone shield, made and kept, because the one eye injury a household can genuinely save is the penetrated one it does not squeeze. *To start:* clean water, a clean cloth, salt, honey, cloves, a candle or lamp for light, and the knowledge of what a normal eye looks like. *First failure to expect:* somebody will rub a burning eye or let a child rub theirs, and the abrasion becomes an ulcer. The second will be a spouse trying to get the bead out with a hairpin.

For a village of 300. A trained healer with four forged instruments, a written register and a drainage set. At this scale a tooth comes out properly, an abscess is drained, a dry socket is dressed, a jaw is wired and an eye injury is recorded daily. *To start:* a smith who has copied the 150 and 151 forceps and a straight elevator from a drawing, a healer who has read the Hesperian chapters and done thirty supervised extractions, a stock of clove and honey, a register of every eye injury and every extraction with the tooth named and the outcome at one week, and a standing rule that two people confirm the tooth before any forceps touches it. *First failure to expect:* the register, again. The second is that the healer will become bold about upper molars and will push a root into a sinus in the first year.

For a district of 3,000. All of the above plus one place where a face is cut. The district's distinguishing capacity is the surgical airway, the drainage of a deep neck space, the closure of an oroantral communication, lid surgery for trichiasis, and the removal of a blind painful eye. *To start:* a nurse or doctor or the nearest thing, a sterile room, forged retractors and a tracheostomy set, a supply of local anaesthetic and whatever antibiotics remain under lock, and the teaching of village healers with audit of their registers. *First failure to expect:* the Ludwig's patient arriving on day four, when the mouth will not open and the airway is already narrow. The district's real work is teaching villages to send them on day one.

Protocols

Protocol 1. The eye that has been injured or is red

- ☐ Ask: how, when, with what, and has anything been put in it.
- ☐ Measure distance vision in each eye separately, however roughly: reading at arm's length, counting fingers, seeing a hand move, seeing light. **Write it down with the date.**
- ☐ Look at the white (should be white apart from a few veins), the black (should be completely black), the size of the two eyes, the direction of gaze, and the lids and lashes.
- ☐ **Stop and shield if:** the pupil is not round, there is dark tissue on the white, fluid is leaking, or there is a visible break in the eyeball. Do not touch it further.
- ☐ Otherwise, evert the upper lid and look under it, unless perforation or a thinned cornea is suspected.
- ☐ Decide: normal vision and no pain means watch, while abnormal vision or severe pain means an emergency you must now treat yourself.
- ☐ Look again every day for four days and write down the vision each time.

Protocol 2. The surface foreign body

- ☐ Light, and a second person to steady the head.
- ☐ Anaesthetic drop if any exists. Wait 1 minute.
- ☐ Moisten a cotton bud or the corner of a clean cloth with boiled, cooled water.
- ☐ Lift the object off with a single gentle upward sweep.
- ☐ If nothing is seen, evert the upper lid and sweep the inside of it.
- ☐ Show the object to the patient.
- ☐ **Do not attempt** anything embedded in the black of the eye, anything in a child who will not hold still, or more than two attempts.
- ☐ Review the next day. Pain that is worse the next day is an ulcer until proved otherwise.

Protocol 3. The chemical burn

- ☐ **Start pouring before you do anything else.** Do not stop to check vision.
- ☐ Protect neck and shoulders with cloth. Tilt the head so the fluid runs away from the good eye.
- ☐ Hold the lids open with fingers or a bent paper clip loop. Pour from no more than 5 cm.
- ☐ Clean water at room temperature is acceptable. Boiled and cooled is better. Salt water at a level teaspoon (about 5 g) in 1 litre is better still.
- ☐ Pour onto the eye, inside the lower lid, and under the everted upper lid.
- ☐ Have the patient move the eye in every direction throughout.
- ☐ **Continue for 30 minutes.** Use 2 to 5 litres. Use 10 litres for lime or ash lye.
- ☐ Wipe out any remaining white particles from the fornices with a moist cotton bud.
- ☐ Rest 10 minutes. If it still stings, or particles remain, irrigate another 15 minutes.
- ☐ Never pour acid on an alkali burn or the reverse.
- ☐ Record vision afterwards. Review daily for a week.

Protocol 4. The eye shield

- ☐ Draw a circle about 8 cm across on thin card, old X-ray film, bark or a plastic bottle, using a cup as a template. Cut it out.
- ☐ Cut one straight slit from the edge to the centre.
- ☐ Overlap the cut edges to form a shallow cone. Tape.
- ☐ Place over the eye so the rim rests on the bone of the brow and cheek. **Nothing must touch the eyeball.**
- ☐ Two strips of tape, one from forehead to cheek, one across.

☐ No pad under it. No pressure. Leave it on.

Protocol 5. The ear

☐ Ask first: has this ear ever discharged or been operated on? If yes, **no water and no syringe, ever.**
☐ Foreign body: one attempt, best light, best hands, child held firmly. Grasp and withdraw along the canal. If it does not come at the first try, stop.
☐ Never irrigate for a bean, a seed, a battery or an ear that has discharged. A battery must come out within hours or go to the district.
☐ Insect: 5 to 10 drops of cooking oil or warm (not hot) oil into the canal with the head tilted, wait 5 minutes for it to stop moving, then remove it or let it float out. No oil if the drum may be torn.
☐ Earache without discharge: analgesia, warmth, sleep propped up. Look again at 48 hours.
☐ Earache still present with fever at 48 to 72 hours, or any child under 2 with both ears, or any child who looks ill: antibiotic if you have it.
☐ Discharge from the ear: keep it dry. Dry mop with a twisted wick of clean cloth two or three times a day. No water, no oil, no drops that are not made for ears.
☐ Otitis externa (pain on pulling the ear, swollen canal, itch): equal parts vinegar and clean water, 3 to 4 drops three times a day for up to 7 days, ear kept dry. Stop and reconsider if not improving at 7 days.
☐ **Stop everything and treat as an emergency if:** swelling behind the ear, facial weakness, neck stiffness, severe headache or drowsiness.

Protocol 6. The extraction

☐ **Identify the tooth. Have a second person confirm it. Say it aloud and write it down.** Mark the record before touching the patient.
☐ Decide it must come out: a dead or dying pulp that cannot be filled, a tooth broken below the gum, a tooth causing a drained abscess that keeps returning.
☐ Do not extract if there is trismus with bilateral swelling, uncontrolled bleeding history, or any doubt about which tooth.
☐ Lay instruments on a clean cloth: syringe, needle, anaesthetic, elevator, spoon or probe, upper and lower forceps, gauze. Wash hands. Gloves if any.
☐ Anaesthetise. Upper teeth by infiltration beside the root. Lower back teeth by block (WO-11, Protocol 1 for the ceiling). **Wait 5 minutes and test that the tooth is numb before starting.** If not numb, inject again, and after a failed lower block add a buccal infiltration rather than repeating the block.
☐ Separate the gum: slide the probe into the pocket to the attachment and work it round the tooth on both the cheek and tongue sides. Cut only the thin attached gum.
☐ Loosen with the elevator: finger resting on bone, blade between the target tooth and the tooth in front, curved face against the target, slide as far under the gum as it will go, turn the handle so the top of the tooth moves backward. **Never lever against the good tooth.**
☐ Forceps: push the beaks as far up the root under the gum as they will go. Support the jaw bone with the other hand.
☐ Movement: one root, turn. Two or three roots, tip back and forth and increase the movement slowly. Front teeth come straight out. Back teeth usually come towards the cheek, some lower molars towards the tongue.
☐ Go slowly. **Hurrying and squeezing break the tooth.**
☐ Examine the tooth that comes out. Count the roots. Compare with the socket.
☐ Press the socket walls together. Gauze over it. **Bite firmly for 30 minutes. A child, 2 hours.**
☐ Suture across the socket with thread if several teeth came out or the gum is loose. Two knots, 0.5 cm of thread left, bite 1 hour, remove at 1 week.
☐ Aftercare: no rinsing for 24 hours, head raised when resting, no hot drinks, plenty of cool water, soft food

chewed on the other side, **warm salt rinses twice a day from day 2** (THRIVING library, HY-12).
- ☐ Review at 48 hours and at 1 week.

Protocol 7. When the extraction goes wrong

- ☐ **Broken root, visible:** lift with a curved elevator. Two attempts only.
- ☐ **Broken root, small and deep:** leave it. Tell the patient. It usually loosens in about a week. Review at 1 week and at 1 month.
- ☐ **Root into the sinus** (air bubbles when the patient gently blows with the nose pinched, or fluid from the nose when drinking): **do not probe for it.** Gauze over the socket, suture the gum across if you can, tell the patient not to blow the nose or sneeze with the mouth closed for 2 weeks, and send to the district within 48 hours.
- ☐ **Bleeding:** more gauze, bite for 5 minutes. Still bleeding, press again for 20 minutes without looking. Still bleeding, suture across the socket. Still bleeding, a tea bag or a wad of cloth soaked in strong cold tea, bitten for 20 minutes [VERIFY, tannin haemostasis widely reported but no trial read].
- ☐ **Swelling after a difficult extraction:** cold wet cloth for the first day to prevent it. Hot wet cloth 30 minutes on and 30 minutes off from day 2 for swelling that has formed, taking care not to scald.
- ☐ **Dry socket** (steady deep pain starting day 2 to 4, bare bone, foul smell): irrigate gently with warm salt water. Place a small pledget of cotton with ground clove in a drop of honey or oil into the socket. Change when the pain returns. Two warm salt rinses a day. If two dressings have not worked, debride the socket and suture the margins.
- ☐ **Dislocated jaw** (cannot close the mouth): thumbs wrapped in cloth on the lower back teeth, press down and back while lifting the chin.

Protocol 8. The dental abscess and the dangerous face

- ☐ Signs of abscess: constant pain including lying down, tooth feels long and slightly loose, hurts when tapped, bubble on the gum near the root tip, swelling of gum or cheek on that side.
- ☐ If there is a soft pointing swelling in the gum: anaesthetise around it, open it with a sterilised sharp blade, let the pus out, do not pack it (THRIVING library, WO-14).
- ☐ If it cannot be drained: warm cloths on the face and warm rinses in the mouth many times a day until the swelling falls.
- ☐ Remove the cause: extract the tooth, or arrange it once the acute swelling settles.
- ☐ Antibiotic for spreading swelling, fever, or a swelling that crosses the midline. Amoxicillin is first choice, with metronidazole added for a foul anaerobic infection (THRIVING library, HY-12 citing IN-05). Finish the course.
- ☐ Pain: paracetamol 500 to 1000 mg or ibuprofen 200 to 400 mg in an adult, every 6 hours, maximum four doses a day (Hesperian). Clove held against the tooth (THRIVING library, WO-11).
- ☐ **Check every few hours for:** swelling under the jaw on both sides, a floor of the mouth that feels hard, the tongue pushed up, drooling, a muffled voice, inability to open the mouth two fingers' width, difficulty swallowing saliva, or noisy breathing.
- ☐ **Any one of those: this is Ludwig's angina.** Sit the patient upright and never lay them flat. Get the source tooth out or drained now if the mouth still opens. Give every antibiotic available. Send for the district at once. Once there is stridor, a village can give only morphine, an upright position, company and the truth.

Protocol 9. The knocked-out tooth

- ☐ Adult tooth only. A baby tooth is never put back.
- ☐ Pick it up **by the crown, never the root.**
- ☐ Do not scrub it, do not rinse it with water. Rinse with milk or salt water (a level teaspoon in 1 litre) for no more than 10 seconds if it is visibly dirty.

- ☐ Put it straight back in the socket the right way round, within 15 minutes if at all possible.
- ☐ If it cannot be replaced, keep it in milk, or in the patient's own mouth inside the cheek. Never in dry cloth and never in plain water.
- ☐ Hold it in place by biting on a folded cloth, then splint to the neighbouring teeth with thin wire or strong thread for **2 weeks**.
- ☐ Soft food, no chewing on it, salt rinses twice a day.
- ☐ After an hour dry, replant anyway and expect to lose it.

Protocol 10. The suspected broken jaw

- ☐ Signs: the teeth no longer meet as they used to, a step in the row of teeth, numb lower lip, bleeding from the gum between two teeth, pain on opening.
- ☐ Support the jaw with a broad bandage under the chin and over the head, loosely enough to open in a hurry.
- ☐ Clear the mouth of broken teeth and clot.
- ☐ At the village: wire or strongly thread the upper and lower teeth together after setting the bite by the patient's own feel of how the teeth met.
- ☐ **Wire cutters or scissors stay beside the patient at all times** in case of vomiting.
- ☐ 4 to 6 weeks in an adult, 2 weeks in a child. Liquid and soft food throughout. Salt rinses after every feed.

Numbers to carry

1. **18 hours.** The window in which Bhaktapur saw no ulcers after a treated abrasion. Treat it as the window for looking, not as a guarantee.
2. **30 minutes and 2 to 5 litres.** The minimum irrigation of a chemically burned eye. Ten litres for lime or ash lye.
3. **1.25 per cent.** The povidone-iodine strength that matched an antibiotic in bacterial keratitis and in conjunctivitis. A 10 per cent surgical stock diluted eight times.
4. **Never evert a lid, never press an eye** when a penetrating wound or a thinned cornea is possible.
5. **One attempt** at a foreign body in an ear. Success falls and complications rise after the first try. The drum perforates in about 4 per cent.
6. **24 hours, nothing. 2 to 3 days, 1 in 20.** The antibiotic effect in earache. Harm is 1 in 14.
7. **5 minutes.** The wait after a dental injection before testing that the tooth is numb.
8. **30 minutes biting on gauze, 2 hours in a child.** After an extraction.
9. **Two people name the tooth before the forceps touch it.** An education programme took wrong-site extraction to zero.
10. **Both sides swollen, tongue up, drooling, cannot open.** Ludwig's angina. Over 50 per cent died before antibiotics. Act on day one, not day three.

References

1. Upadhyay MP, Karmacharya PCD, Koirala S, Shah DN, Shakya S, Shrestha JK, Bajracharya H, Gurung CK, Whitcher JP. The Bhaktapur eye study: ocular trauma and antibiotic prophylaxis for the prevention of corneal ulceration in Nepal. British Journal of Ophthalmology, 2001, 85(4), 388-392. https://bjo.bmj.com/content/85/4/388 (abstract and article landing page read)
2. O'Brien KS, Lietman TM, Keenan JD, Whitcher JP. Microbial keratitis: a community eye health approach. Community Eye Health, 2015, 28(89), 1-2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4579989/ (read in full)
3. Village Integrated Eye Workers Trial (VIEW), NCT01969786, Chitwan and Nawalparasi, Nepal. https://clinicaltrials.gov/study/NCT01969786 (registry record and published-results summaries read, full paper not read)

4. World Health Organization Regional Office for Africa. Primary Eye Care Training Manual. WHO AFRO, 2018. https://www.afro.who.int/sites/default/files/2018-06/WEB-2835-OMS-Afro-PrimaryEyeCaretrainingmanual-20180406.pdf (PDF downloaded and text extracted, algorithms and skill protocols read in full)
5. Lim CHL, Turner A, Lim BX. Patching for corneal abrasion. Cochrane Database of Systematic Reviews, 2016, CD004764. https://www.cochrane.org/evidence/CD004764_eye-patches-corneal-abrasion (plain-language summary read)
6. Prajna NV, Krishnan T, Mascarenhas J and others. The Mycotic Ulcer Treatment Trial: a randomized trial comparing natamycin vs voriconazole. JAMA Ophthalmology, 2013. https://pmc.ncbi.nlm.nih.gov/articles/PMC3769211 (abstract and EyeWiki summary read)
7. EyeWiki (American Academy of Ophthalmology). Mycotic Ulcer Treatment Trial 1 and 2. https://eyewiki.org/Mycotic_Ulcer_Treatment_Trial_1_%26_2 (read)
8. Isenberg SJ and others. Povidone-iodine 1.25% for bacterial keratitis: a randomized trial. American Journal of Ophthalmology, 2017. Reported in: Povidone-iodine promising for bacterial keratitis in the developing world, Healio, 2016. https://www.healio.com/news/optometry/20161230/povidoneiodine-promising-for-bacterial-keratitis-in-developing-world (secondary summaries read, original not reached)
9. American Academy of Ophthalmology EyeNet. Another role for povidone-iodine. https://www.aao.org/eyenet/article/another-role-povidone-iodine (read)
10. Srinivasan M, Gonzales CA, George C and others. Epidemiology and aetiological diagnosis of corneal ulceration in Madurai, south India. British Journal of Ophthalmology, 1997, 81(11), 965. https://bjo.bmj.com/content/81/11/965 (abstract and secondary summaries read)
11. Brown L, Leck AK, Gichangi M, Burton MJ, Denning DW. The global incidence and diagnosis of fungal keratitis. Lancet Infectious Diseases, 2021 (manuscript copy). https://lshtm-eprints-repo-prod.lshtm-eprints.cdl.cosector.com/4658410/1/Brown%20et%20al%20Manuscript%20final%204.docx (search summary of manuscript read, not full text)
12. Hoffman JJ, Burton MJ, Leck A. Mycotic keratitis: a global threat from the filamentous fungi. LSHTM eprints. https://lshtm-eprints-repo-prod.lshtm-eprints.cdl.cosector.com/4662003/1/Mycotic%20Keratitis-A%20Global%20Threat%20from%20the%20Filamentous%20Fungi.pdf (search summary read)
13. Therapeutic potential of honey and propolis on ocular disease. PubMed record 36422549. https://pubmed.ncbi.nlm.nih.gov/36422549/ (abstract read)
14. Comparative study between topical insulin, autologous serum and honey-based eye drops as adjunctive treatment in resistant corneal ulcer. Delta Journal of Ophthalmology, 2023, doi 10.4103/djo.djo_59_23. https://www.citedrive.com/en/discovery/comparative-study-between-topical-insulin-autologous-serum-and-honey-based-eye-drops-as-adjunctive-treatment-in-resistant-corneal-ulcer (record and summary read)
15. Honey-related treatment strategies in dry eye disease. Pharmaceuticals, 2023. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10222400/ (abstract and summary read)
16. Royal Victoria Eye and Ear Hospital. Chemical Injuries of the Eye Clinical Practice Guideline, 2022 (hosted by Eye and Ear Foundation). https://eyeandear.org.au/wp-content/uploads/2021/11/Chemical-Injuries-of-the-Eye-Clinical-Practice-Guideline1.pdf (search summary read, PDF not opened)
17. The Wills Eye Manual, chemical burn chapter, editions 8 and 9 web copies. https://download.skyscape.com/download/ota/lonestar/7E9C9B3D-3844-4FAC-979B-F22B76166213/willseye.ed9/content/HTML/w/tl0.htm (search summary read)
18. RCEM Learning. Acute angle closure glaucoma. https://www.rcemlearning.co.uk/modules/atraumatic-red-eye/lessons/acute-angle-closure-glaucoma-aacg/ (summary read)
19. WikEM. Acute angle-closure glaucoma. https://wikem.org/wiki/Acute_angle_closure_glaucoma (summary read)
20. American Academy of Ophthalmology EyeNet. Open globe injury. https://aao.org/eyenet/article/open-globe-injury (summary read)

21. emDocs. Open globe injury, podcast episode 79 and associated post. https://www.emdocs.net/emdocs-podcast-episode-79-open-globe-injury/ (summary read)
22. University of Iowa EyeRounds. HSV keratitis atlas. https://webeye.ophth.uiowa.edu/eyeforum/atlas/pages/HSV-keratitis/index.htm (summary read)
23. Multifocal atypical herpetic keratitis secondary to topical corticosteroids. MedUNAB. https://revistas.unab.edu.co/medunab/article/view/3637 (summary read)
24. RCEM Learning. Corneal foreign bodies and rust rings. https://www.rcemlearning.co.uk/modules/corneal-injuries/lessons/management-16/topic/corneal-foreign-bodies-and-rust-rings-2/ (summary read)
25. Patient Care Online. Metallic corneal foreign body with rust ring. https://www.patientcareonline.com/view/metallic-corneal-foreign-body-rust-ring (summary read)
26. NHS Scotland eyecare guidelines, 5.16 Photokeratitis (ultraviolet burn, arc eye, snow blindness). https://www.eyes.nhs.scot/eyecare-guidelines/section-5-corneal/516-photokeratitis-ultraviolet-burn-arc-eye-snow-blindness/ (summary read)
27. Prevalence of trachoma in Benishangul Gumuz Region, Ethiopia, after implementation of the SAFE strategy. PMC10578310. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10578310/ (abstract and summary read)
28. Task shifting in primary eye care: how sensitive and specific are common signs and symptoms to predict conditions requiring referral to specialist eye personnel? Human Resources for Health, 2014, 12(Suppl 1), S3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4108919/ (abstract and summary read)
29. Courtright P and others. Traditional eye medicine use among patients with corneal disease in rural Malawi. British Journal of Ophthalmology, 1994, 78(11), 810. https://bjo.bmj.com/content/78/11/810 (abstract and secondary summary read)
30. Traditional eye medicine and corneal ulceration: a case-control study. British Journal of Ophthalmology, 1995, 79(4), 343. https://bjo.bmj.com/content/79/4/343 (abstract read)
31. Incidence and complications of traditional eye medications in Nigeria in a teaching hospital. PubMed 21180431. https://www.ncbi.nlm.nih.gov/pubmed/21180431 (abstract read)
32. Traditional eye medicine in rural Somalia: culturally safe harm reduction. Clinical Ophthalmology, volume 20. https://www.dovepress.com/traditional-eye-medicine-in-rural-somalia-culturally-safe-harm-reducti-peer-reviewed-fulltext-article-OPTH (summary read)
33. Couching and cataract extraction: a clinic-based study in northern Nigeria. Community Eye Health Journal. https://cehjournal.org/?p=3053 (summary read)
34. Changing patterns of cataract services in north-west Nigeria, 2005-2016. Sightsavers research. https://research.sightsavers.org/publications/changing-patterns-of-cataract-services-in-north-west-nigeria-2005-2016/ (summary read)
35. Marin JR, Trainor JL. Foreign body removal from the external auditory canal in a pediatric emergency department. Pediatric Emergency Care, 2006. Discussed in: aliem.com, PEM search and rescue, ear foreign bodies. https://www.aliem.com/pem-search-rescue-ear-foreign-bodies/ (secondary summary read)
36. Ear canal foreign bodies in a single institution's emergency department (1,197 children), poster. https://busyadults.slu.edu/medicine/otolaryngology/research/eacfbpsdposter.pdf (poster abstract summary read, not peer reviewed)
37. emDocs. EM@3AM: pediatric aural foreign bodies. https://www.emdocs.net/em3am-pediatric-aural-foreign-bodies/ (summary read)
38. Prehospital lidocaine for an insect in the external auditory canal, case report. Clinical Practice and Cases in Emergency Medicine (eScholarship copy). https://journalpub.escholarship.org/uciem_cpcem/article/48649/galley/48081/download (summary read)
39. GP Notebook. Syringing to remove ear wax: technical details, including contraindications. https://gpnotebook.com/pages/neurology/syringing-to-remove-ear-wax-/technical-details (read)
40. Ear syringing safety and complications, Community Ear and Hearing Health review.

https://account.cehh.press.lshtm.ac.uk/index.php/s-j-cehh/article/download/201/304 (summary read)
41. Venekamp RP, Sanders SL, Glasziou PP, Rovers MM. Antibiotics for acute otitis media in children. Cochrane Database of Systematic Reviews, CD000219. https://www.cochrane.org/CD000219/ARI_antibiotics-children-middle-ear-infection-acute-otitis-media (plain-language summary with effect estimates read in full)
42. Antibiotic treatment to prevent pediatric acute otitis media infectious complications: a meta-analysis. PMC11182555. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11182555/ (abstract and summary read)
43. Hansen MP and others. Mastoiditis after acute otitis media in UK general practice. British Journal of General Practice, 2020, 70(693), e255. https://bjgp.org/content/70/693/e255 (abstract and accepted manuscript summary read)
44. Spontaneous healing of traumatic tympanic membrane perforation: West African prospective study of 53 patients. Clinical Otolaryngology, 2008. PubMed 18983374. https://www.qxmd.com/r/18983374 (abstract summary read)
45. Traumatic tympanic membrane perforation, Yazd, Iran, 202 patients. Tehran University Medical Journal, 2008, 65(2), 57-61. https://tumj.tums.ac.ir/article-1-834-en.html (abstract read)
46. Traumatic perforation: aetiology, outcome and factors affecting the outcome, Nepal, 60 patients. Journal of Universal College of Medical Sciences. https://www.nepjol.info/index.php/JUCMS/article/view/54471 (abstract read)
47. Aural toilet (ear cleaning) for chronic suppurative otitis media. Cochrane Database of Systematic Reviews, CD013057. https://www.cochrane.org/evidence/CD013057_what-are-benefits-and-harms-ear-cleaning-treat-inflammation-and-infection-middle-ear (plain-language summary read)
48. Antibiotics versus topical antiseptics for chronic suppurative otitis media. Cochrane Database of Systematic Reviews, CD013056. https://cochranelibrary.com/cdsr/doi/10.1002/14651858.CD013056.pub2 (abstract summary read)
49. Kaushik V, Malik T, Saeed SR. Interventions for acute otitis externa. Cochrane Database of Systematic Reviews, 2010, CD004740. https://www.cochrane.org/CD004740/ENT_interventions-acute-otitis-externa (plain-language summary read)
50. Dickson M. Where There Is No Dentist. Hesperian Health Guides, 1983, revised printings to 2024. Chapter 11, The instruments you need. https://en.hesperian.org/hhg/Where_There_Is_No_Dentist:The_Instruments_You_Need:_Taking_Out_a_Tooth (read in full)
51. Dickson M. Where There Is No Dentist. How to take out the tooth. https://en.hesperian.org/hhg/Where_There_Is_No_Dentist:How_to_Take_Out_the_Tooth (read in full)
52. Dickson M. Where There Is No Dentist. Problems that can occur. https://en.hesperian.org/hhg/Where_There_Is_No_Dentist:Problems_That_Can_Occur (read in full)
53. Dickson M. Where There Is No Dentist. Tooth abscess. https://en.hesperian.org/hhg/Where_There_Is_No_Dentist:Tooth_A (read in full, dose table extracted imperfectly)
54. Cope AL, Francis N, Wood F, Chestnutt IG. Systemic antibiotics for symptomatic apical periodontitis and acute apical abscess in adults. Cochrane Database of Systematic Reviews, 2024, CD010136.pub4. https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD010136.pub4/information (record and summaries read, full review not reached)
55. BMJ Best Practice. Dental abscess, management approach and complications. https://bestpractice-bmj-com.bibliotheek.ehb.be/topics/en-gb/1206/management-approach (summary read)
56. Candamourty R, Venkatachalam S, Babu MRR, Kumar GS. Ludwig's angina: an emergency, a case report with literature review. Journal of Natural Science, Biology and Medicine, 2012. https://pmc.ncbi.nlm.nih.gov/articles/PMC3510922/ (read in full)
57. Efficacy of different methods used for dry socket prevention and risk factor analysis: a systematic review. PMC5813994. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5813994/ (abstract and summary read)

58. Comparative study of two different techniques for management of dry socket (Nepal, 42 patients). Journal of Nepalgunj Medical College. https://nepjol.info/index.php/JNGMC/article/view/13397 (abstract read)
59. A comparative study to evaluate the effect of honey and zinc oxide eugenol in dry socket. Aga Khan University scholars record. https://scholars.aku.edu/en/publications/a-comparative-study-to-evaluate-the-effect-of-honey-and-zinc-oxid/ (abstract read)
60. Incidence of accidents and complications in oral surgery at a graduate school clinic in Teresina-Piaui. Research, Society and Development. https://rsdjournal.org/rsd/article/view/47958 (abstract and summary read)
61. Efficiency of risk factors causing complication during tooth extraction: a cross-sectional study (Turkey, 186 extractions). https://openaccess.mku.edu.tr/items/ffba5dff-3634-4acf-956b-7de54a2ef011/full (abstract and summary read)
62. The epidemiological pattern of oroantral communication: a retrospective study. https://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.mhp-55711e46-f249-496a-a2d3-5391b8559552/c/the_epidemiological_pattern_of_oroantral_communication_-_a_retrospective_study.pdf (summary read)
63. Oroantral communication after extraction of upper teeth, Lublin series of 970 extractions. Dental and Medical Problems, 2014, 51(2), 173. https://dmp.umw.edu.pl/pdf/2014/51/2/173.pdf (summary read)
64. DrBicuspid. Incidents of preventable dental mistakes rising (NHS England never events analysis, 2015-2019). https://www.drbicuspid.com/dental-practice/article/15375471/incidents-of-preventable-dental-mistakes-rising (read)
65. Prevalence and predictors of wrong tooth extraction in Eastern Province, Saudi Arabia. Imam Abdulrahman Bin Faisal University research record. https://iau.sa.elsevierpure.com/en/publications/prevalence-and-predictors-of-wrong-tooth-extraction-in-eastern-pr/ (record and summary read)
66. Experience of wrong-site tooth extraction among Nigerian dentists. University of Lagos repository. https://ir.unilag.edu.ng/handle/123456789/6443 (abstract read)
67. Wrong-site tooth extraction rates at a Taiwanese university hospital before and after an educational programme. National Taiwan University scholars record. https://scholars.lib.ntu.edu.tw/handle/123456789/569728 (record and summary read)
68. Ockerman A and others. Tranexamic acid and bleeding in patients treated with non-vitamin K oral anticoagulants undergoing dental extraction: the EXTRACT-NOAC randomized clinical trial. PLoS Medicine, 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8128271/ (abstract and summary read)
69. Success rate of 4 injection protocols for mandibular first molars with symptomatic irreversible pulpitis, trial protocol document. https://cdn.clinicaltrials.gov/large-docs/22/NCT04929522/Prot_SAP_000.pdf (summary read, not peer reviewed)
70. Supplementary injections to increase numbers of patients receiving pain-free dental treatment (Kanaa and others). National Elf Service. https://nationalelfservice.net/publication-types/randomised-controlled-trial/supplementary-injections-to-increase-numbers-of-patients-receiving-pain-free-dental-treatment (summary read)
71. International Association of Dental Traumatology. Avulsion of permanent teeth, 2020 guideline, University of Maryland hosted copy. https://www.Dental.Umaryland.Edu/media/sod/dental-public-health/deans-faculty/ebd/iadt/Avulsion-of-permanent-teeth.pdf (secondary summaries read, original not opened)
72. de Amorim RG, Frencken JE, Raggio DP, Chen X, Hu X, Leal SC. Survival percentages of atraumatic restorative treatment (ART) restorations and sealants in posterior teeth: an updated systematic review and meta-analysis. Clinical Oral Investigations, 2018. https://link.springer.com/article/10.1007/s00784-011-0513-3 (2012 version and 2018 update figures read through abstracts and summaries)
73. Frencken JE. The state of the art of ART restorations. Dental Update, 2014, 41, 119-124. https://dental-update.co.uk/content/cariology/the-state-of-the-art-of-art-restorations (summary read)
74. Pierre Fauchard. Wikipedia. https://en.wikipedia.org/wiki/Pierre_Fauchard (read)
75. The life of Pierre Fauchard (1678-1761). PMC7872641. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7872641/

(abstract and summary read)
76. Bath Medical Museum. Teeth pullers and denture makers. https://bathmedicalmuseum.org/teeth-pullers-and-denture-makers/ (read)
77. Wire osteosynthesis and maxillomandibular fixation for mandibular fractures in a resource-poor setting, Aminu Kano Teaching Hospital. University of Jos repository. https://dspace.unijos.edu.ng/jspui/bitstream/123456789/2550/1/AfrJTrauma3124-66719_001107.pdf (summary read)
78. Closed reduction with indirect fixation of mandibular fractures in a low-resourced hospital, Sunyani, Ghana, 268 patients. Craniomaxillofacial Trauma and Reconstruction. https://mdpi.com/1943-3883/17/1/5 (summary read)
79. Deep neck space infections of odontogenic origin: fascial spaces, danger signs and complications. Journal of Urgent Care Medicine clinical article, 2021. https://jucm.com/wp-content/uploads/2021/03/2021-15619-23-Clinical.pdf (summary read)