



Bite sized tips: mammalian bites

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Practice Pointer

Bite sized tips: mammalian bites

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What you need to know

- While a dog's bite strength is proportionate to its jaw shape and size, all dogs can cause significant damage with repeated bites or tearing. Feline bites are commonly puncture wounds.
- Copiously irrigate all bite wounds. Smaller bites may be left to heal by secondary intention – with the exception of the face, which is sutured for cosmetic reasons. Larger bites require reapproximation with interrupted sutures. Never close puncture wounds.
- Antibiotic prophylaxis (e.g. oral amoxicillin-clavulanate for 3 to 5 days) should be given for human bites, most cat bites, bites to high-risk areas (face, hands/feet, genitals), deep injuries, or bites closed primarily.

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1 Introduction

2 Domestic and wild mammalian bite wounds are on the rise .[1–4] Annually, 15 in 100,000
3 adults in the England are hospitalized for dog bites – rising two-fold from 1998-2018, faster
4 than the rise in dogs.[5] Other studies estimate 17 in 1000 individuals suffer animal bites
5 annually, predominately from dogs, cats and monkeys.[3] Cat bites are highest among
6 women and children and comprise 3% to 25% of all bite wounds, with significant geographic
7 variation.[6,7] In some areas, dog bites among children increased during the COVID-19
8 pandemic.[8]

9
10 Mammalian bite wounds have high risks of infection and complication[9,10], which can be
11 lowered with proper management. Here we offer generalist and acute care physicians a
12 practical approach to wound management, infectious considerations and public health
13 implications, with a special focus on dogs, cats and humans. Adapt our guidance to local
14 expertise, resources and protocols.

16 Acute bite wound management

17 *What information should I ask on history?*

18 Important components are outlined in **BOX 1**.

20 *How do I approach the physical exam?*

21 *Control the bleeding*

22 Prioritize life- or limb-threatening injuries. Control ongoing bleeding with *continuous* direct
23 pressure (at least 10 minutes); uncontrolled significant bleeding can be temporised with
24 watertight haemostatic closure of the skin (i.e. circumferential whipstitch). A tourniquet can
25 temporarily control life-threatening extremity bleeding but should be inflated no more than 2
26 hours[11] and prompt immediate surgical consultation.

28 *Assess the wound(s)*

29 Identify the number and locations of injuries, including secondary injuries from falls or other
30 trauma from the attack.

31
32 Regardless of wound location, assessment principles are similar (**BOX 2**). Consider
33 important anatomic structures near the injury.

1 *Face and scalp*

2 Examine cranial nerves with special attention to CN VII (motor function to face, with 5 major
3 branches travelling between the tragus and the lateral pupil) and CN V (sensation to the upper
4 [brow, V1], middle [cheek, V2] and lower [jaw, V3] face). Motor nerve deficit requires
5 urgent (<72 hours) operative repair for best outcomes.[12]

6
7 Children are at higher risk of dog bites to the head and neck.[13] The soft skull can easily be
8 penetrated by animal teeth. Have a low threshold for CT imaging if there is suspicion for
9 injury to deeper structures.[14,15]

10 *Neck*

11 Major essential structures pass through the neck, including the carotid vessels, cervical
12 nerves, esophagus and trachea. Injuries can be occult and require careful examination
13 (detailed elsewhere[16]). Document a neurologic exam (stroke-like symptoms may suggest
14 vascular injury) and an aerodigestive exam (including stridor, haemoptysis/hematemesis,
15 drooling, dysphonia, and dysphagia).

16
17
18 Maintain a low threshold for CT imaging and surgical consultation. Cervical spine
19 immobilization is not typically necessary unless there were significant traumatic forces.

20 *Extremities*

21 Perform a focused neurovascular exam of the affected extremity (including comparison to the
22 contralateral side). Look for signs of impaired distal circulation (dusky appearance, delayed
23 capillary refill) and neurologic deficit. Note deficits may be from neuropraxia from edema,
24 transient stretch or complete transection. Lacerations over tendons should explore the tendon
25 through its range of motion.

26
27
28 Hands are involved in up to half of all cat bites[6], dog bites to adults[17,18] and human
29 bites.[19] Hand injuries require nuanced management (covered elsewhere).

30
31 When a patient cannot move their finger(s), testing the tenodesis effect (see **FIGURE 1**) can
32 help distinguish tendon injuries from nerve injuries or pain-related guarding. With nerve,
33 musculotendinous or bony injury, reduce fractures and immobilise the limb in position of

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safety (**FIGURE 2**). Refer to a specialist for definitive management. Operative repair of nerve lacerations should be done within 72 hours of injury.[12]

Tissue viability

For partially avulsed or amputated parts, note signs of decreased viability, including dusky appearance, delayed capillary refill, gross contamination or loss of deeper structures. Thankfully, when closed appropriately these tissues may regain vascularity.

Which bite wounds may be closed?

Bite wounds carry a high risk of infection due to inoculation of oral bacteria. Not all should be closed (**BOX 3**).

Primary wound closure weighs function and cosmesis against infection; it should be a shared decision between clinicians and patients. A 2019 Cochrane review of dog bites did not find evidence that primary closure reduces rates of infection or affects cosmesis, based on weak evidence.[20]

How do I prepare the wound for closure?

Have a low threshold for radiographic imaging to rule out fracture or tooth fragments. After sensorimotor exam, anesthetize the wound using topical, local or regional anesthesia.[21]

While there is little evidence quantifying the impact of irrigation on infection of bite wounds, most guidelines recommend its use, as bite wounds are considered grossly contaminated.[22–25] Cleansing with soap reduces the risk of rabies transmission.[26] Use sterile saline or potable water to copiously irrigate the wound (we suggest 1L for smaller wounds and 1-3L for larger wounds), manipulating tissues to liberate debris and bacteria.[27] Consider bringing cooperative patients to the sink for irrigation under running water. For puncture wounds, try gently flushing with an 18 gauge cannula attached to a syringe; ensure irrigation fluid drains out. After flushing, use an antiseptic agent such as soap, povidone-iodine or polyhexanide to help reduce infection.[25,28]

Inspect the wound and nearby structures, removing clearly devitalized tissues. Cosmesis may be improved by smoothing jagged edges (use a scalpel or iris scissors), to neatly approximate skin edges during primary closure.[29] Large defects in tissues require surgical involvement.

There is no high-quality evidence guiding bite wound closure techniques. We recommend staples (except on the face and hands/feet) or simple interrupted nonabsorbable monofilament sutures, to permit partial removal if infection occurs. Avoid glue, which seals in bacteria. Minimize deep sutures – an additional nidus for infection – but if necessary (e.g., gaping wounds), use an absorbable *monofilament*. For extremity injuries, consider splinting in a position of safety (**FIGURE 2**).[30]

What injury patterns require unique considerations?

[6][5]Crush and puncture wounds are at risk of underlying fracture – consider X-ray imaging.[6] Let all puncture wounds heal by secondary intention (after irrigation).[29] Signs of crush syndrome or compartment syndrome warrant specialist involvement.

With partial tissue avulsions (soft tissue flaps), clean with antimicrobial solution, replace parts into anatomic position, close the skin (only) and cover with a non-stick dressing.[29]

Manage amputated parts in the standard fashion: gentle irrigation, wrapping in saline-soaked gauze, placing in a plastic bag, then on ice, with emergent specialist referral.[31]

When should I involve a surgical specialist?

Consult a surgical service for challenging wounds or any identified deficits (**BOX 4**). A specialist's scope of practice varies by centre. Refer to local algorithms.

Infectious Diseases Considerations

When do I offer antibiotic prophylaxis?

Consider antibiotic prophylaxis for mammalian bite wounds that violate the dermis. (**BOX 5**).[23,32–35]

Evidence in this area is limited. A meta-analysis of 8 small randomised controlled trials (RCT) of mammalian bites found antibiotic prophylaxis reduced infection risk only for human bites (OR 0.02; 95% CI, 0.00 to 0.33) and bites to the hand (OR 0.10; 95% CI 0.01 to 0.86).[20] A more recent small RCT found antibiotic prophylaxis had a non-significant 4% absolute risk reduction for dog bite wound infection (95% CI –1.0% to 4.5%).[36]

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Which antibiotics do I choose for prophylaxis?

Oral amoxicillin-clavulanate is usually first line, covering mixed organisms from mammalian bites (TABLE 1).[23,32,33] Second line alternatives include metronidazole plus either doxycycline or trimethoprim/sulfamethoxazole. Antibiotic prophylaxis is typically 3 to 5 days.[23,32]

When should I consider rabies prophylaxis?

Consider rabies post-exposure prophylaxis (PEP) for all mammal bites (BOX 6) and consult local guidelines.[37]

Rabies is a viral infection, transmitted via bite from an infected animal.[38] In humans, rabies causes an incurable and fatal encephalitis.[38,39] It classically presents with hyperactivity, hydrophobia, and pharyngeal spasms, progressing to paralysis and death.[39]

Annually, rabies causes 59,000 deaths worldwide, predominantly (95% of cases) in Africa and Asia.[40] Globally, 99% of human rabies is transmitted by dogs[40], though this varies by country. All 26 human rabies cases in United Kingdom since 1946 were acquired outside the country.[41] In the United States, bats are the leading cause of human rabies.[42]

How do I administer rabies prophylaxis?

Post exposure prophylaxis involves both human immunoglobulin (RIG) and rabies antibody vaccine (RABV). RIG (dose: 20 IU/kg) should be administered within seven days.[25] Infiltrate as much as feasible into the wound; inject the remainder intramuscularly proximal to the injury, at a separate site from RABV.[25]

The WHO RABV schedule for unvaccinated patients is 1 entire vial administered intramuscularly on day 0, 3, 7 and 14.[25] Pre-established pathways for vaccine visits facilitate patient care.

Should I consider tetanus prophylaxis?

Bite wounds can develop tetanus[43]. Tetanus toxoid vaccine and immunoglobulin should be offered according to local protocols and administered immediately. As an example, 0.5mL of

1 tetanus toxoid vaccine should be given intramuscularly and 250 units (IU) of tetanus
2 immunoglobulin should be given intramuscularly at a different site.[44]

3 4 ***What are the risks of wound infection?***

5 Risk of infection varies by offending mammal, anatomic region, wound factors and patient
6 risk factors (see **BOX 5**).[45–47]

7
8 Mammalian bite wounds have a high risk of infection – about 2-25% of dog bites,[9] 30% to
9 50% of cat bites[9], and up to half (47%) of human bites[48] – which increases with delay to
10 presentation and size of wound.[10,49] While only 8% of human bites are closed-fist (“fight
11 bite”) injuries[19], a recent systematic review[50] reported frequent infectious complications,
12 including tenosynovitis (36%), septic arthritis (70%) and osteomyelitis (48%).

13
14 In a case series of 107 patients, the median time of infection was 25 hours (18-54 hours)
15 after dog or cat bites.[18] A prospective study from Sweden found symptoms of infection can
16 occur as early as 3 hours following cat bites.[51] Purulence, cellulitis/lymphangitis and fever
17 were observed in 48%, 36% and 11% of bite infections, respectively.[18]

18
19 Transmission of bloodborne viral infections such as HIV from human bites is very low.[52]

20 21 ***How do I manage an infected bite wound?***

22 General principles of wound infection management apply. Sutured wounds should be
23 reopened to drain and heal by secondary intention.[23] Pack deep wounds with twice daily
24 dressing changes; use topical antimicrobial soaks to reduce infectious burden. Drain
25 abscesses, irrigate copiously and leave open with packing.[23] Determine depth of infection
26 by clinical exam and imaging if required. Send tissue or swab(s) of purulence for culture; this
27 guides antibiotic treatment. Use intravenous antibiotics if the patient is systemically unwell or
28 has a rapidly progressing infection.

29 30 ***When do I involve an infectious diseases specialist?***

31 Consider seeking advice for infected bite wounds (**BOX 5**).

32 33 **Public health considerations**

34 ***What are public health strategies to minimise canine bites?***

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1 Injury prevention practices and public policy can reduce bite incidents. Never leave children
2 unattended with dogs, muzzle or leash dogs in public and adopt stress-reducing protocols
3 when handling animals.[53,54]

4
5 Prevention strategies tailored to the home environment are important, as most bites occur
6 there.[5] Prevention is not breed-specific and should focus on education as well as on
7 developing effective physical barriers and reporting strategies.[55,56] Recognise early signs
8 of stress behaviours in a dog and remove the stressor or the animal from the environment;
9 otherwise, utilize physical barriers (e.g., muzzles, letter box cages, child-gates) to avoid
10 injury.[55]

11
12 ***How can we prevent other mammalian bites?***

13 Public health strategies here are lacking. There are also no bite prevention guidelines on
14 domestically kept wild animals (e.g., wildcats).

15
16 Many countries are developing strategies to minimise human-wildlife conflict. For example,
17 Ontario, Canada developed the ‘Bear Wise’ program, which uses a co-ordinated approach to
18 educate around preventing conflict with black bears (i.e., not feeding / approaching bears,
19 cleaning BBQs, removing bird feeders), reporting incidents, and response tactics.[57]

20
21 ***Am I obligated to report bites?***

22 Rabies is notifiable in the WHO’s Terrestrial Animal Health Code. If you suspect a rabid
23 animal, notify local public health authorities (often the Medical Officer of Health) or
24 veterinary authorities (who then inform the World Organization for Animal Health).[58]

25
26 Legal requirements for reporting bites varies between nations. While many nations have
27 legislation concerning dangerous dogs, few mandate formal reporting. France is one of the
28 few countries with both.[59,60] In England and Wales, the Dangerous Dog Act 1991 bans
29 certain breeds, and makes it a criminal offence to own a dangerously out of control dog,
30 however there is no mandate to report a dog bite or attack.[61]

31
32 **Mandatory boxes (3):**

33 **How this article was created**

We searched the past 5 years of BMJ articles using the search term “bite”. For topic specific questions, authors searched resources including Cochrane Database of Systematic Reviews, Turning Research Into Practice (TRIP) database and MEDLINE, using medical subject headings (MeSH) and non-MeSH terms specific to the topic (for example, [“Bites and stings” OR “Bite*”] AND [“Animals” OR “Mammals”] were then combined with topics related to the research question such as “Bacteriology” or “Irrigation” or “Wound management”. World Health Organization (WHO), World Organisation for Animal Health (WOAH), national public health (e.g. National Institute for Health and Care Excellence NICE guidelines) and society (e.g. Infectious Diseases Society of America IDSA) guidelines were searched for bite management strategies, rabies policies, and dangerous dogs guidance and legislation.

How patients were involved in the creation of this article

We interviewed two patients who have recovered from bite wounds. This article was modified with their suggestions.

Education into practice

- What do you do in your management of patients with acute bite wounds to minimize the risk of infection?
- Which animals in your region carry rabies (and would require prophylaxis)? Which local guidelines and resources do you use to guide your decision making?

Contributorship and the guarantor

ICG conceived the article and is the guarantor. All authors contributed to the content outline. ICG, JT and AB co-wrote the first draft. All authors reviewed the article and created the boxes.

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Conflicts of Interest

“Competing Interest: None declared for all authors.”

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BOX 1: key factors to note on history.

Animal and injury factors

- Species and size of animal
- Animal’s rabies immunisation status (if known)
- Mechanism of attack (scratch vs single bite vs multiple bites vs clenched jaw with shaking)
- When the injury occurred
- Circumstances of the attack (as opportunities for future prevention education)

Patient factors

- Extremes of age (which predisposes to more severe injury as well as to infection and subsequent complications)
 - Hand dominance
 - Occupation and important hobbies
 - Prior injuries or functional limitations to the affected area
 - Patient’s tetanus and rabies vaccination status
 - Risk factors for infection (e.g., immunocompromised conditions, immunosuppression, asplenia, diabetes)
 - Risk factors for impaired healing (e.g., peripheral vascular disease, steroid use and smoking)
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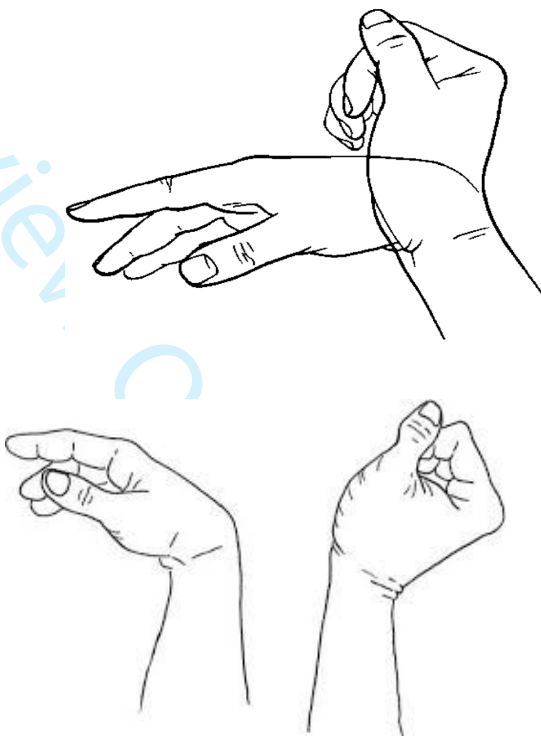
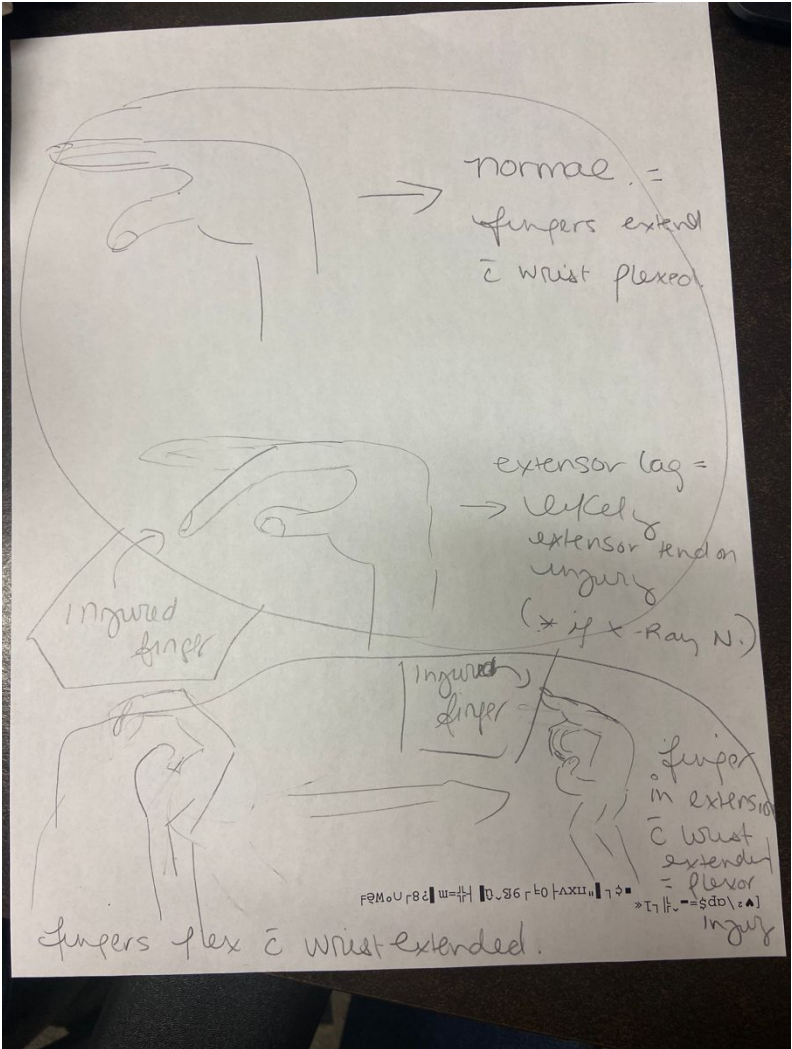
BOX 2: General wound assessment principles:

- Vascular status distal to the injury (for extremity injuries) and consider CT for potential major vascular injuries.
- Motor function (note a deficit can be caused by nerve or muscle injury)
- Nerve function (both at and distal to the wound)
- Tendon and muscle function (assess structures through range of motion actively when possible or passively with tenodesis effect[62,63]; see **FIGURE 1**)
- Bony injury and foreign body (tooth) remnants (i.e. with x-ray).

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FIGURE 1: Tenodesis can help differentiate a tendon injury from nerve injury or pain-related guarding when a patient cannot move their fingers after an injury. With the limb fully relaxed, flexion at the wrist normally extends the digits (left side of image) and extension of the wrist flexes the digits (right side of image). Fingers will follow this pattern in the presence of nerve injury, but not in the presence of (complete) tendon laceration. It is still necessary to consider sensation in distal nerve distribution to be able to rule out nerve injury if the laceration involves or crosses the course of a major nerve. Diagnostic sensitivity and specificity of this manoeuvre are not known. (figure from article doi: 10.1016/0363-5023(92)90371-u, to be used as the basis for illustration by BMJ illustrators.)

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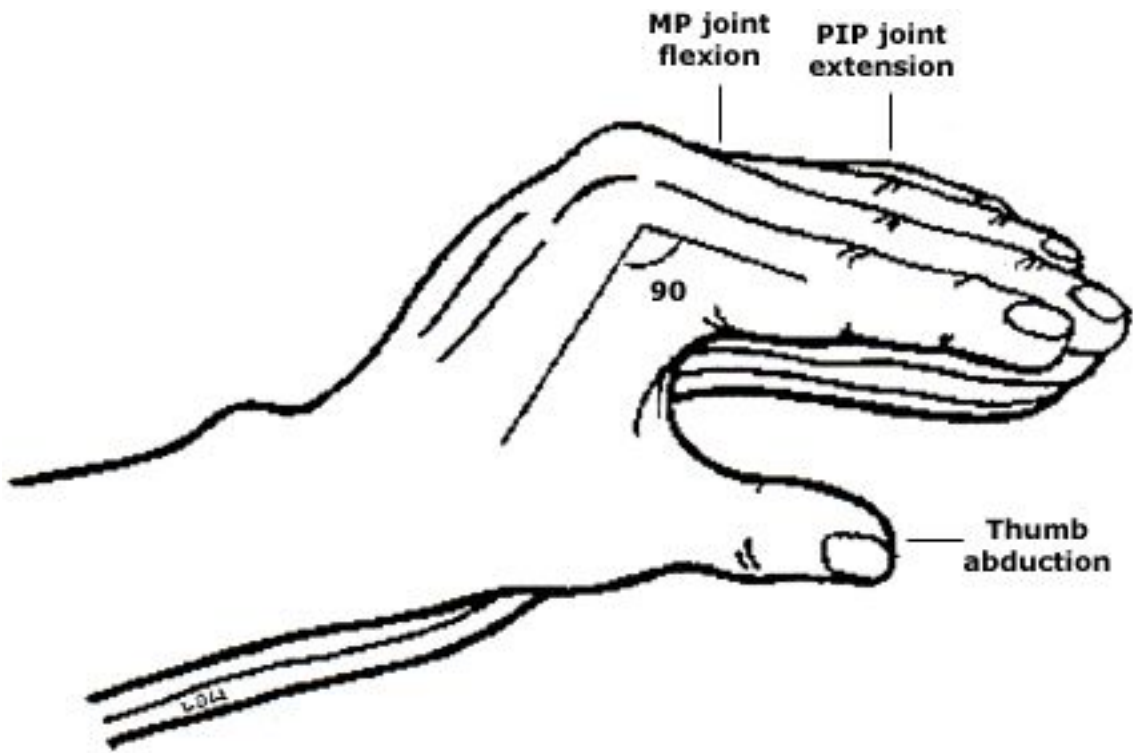
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FIGURE 2: position of safety



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The safe position shows the wrist extended 20 degrees, MCP joints flexed at 90 degrees, and the PIP and DIP joints fully extended.

MCP: metacarpophalangeal; PIP: proximal interphalangeal; DIP: distal interphalangeal.

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BOX 3: Primary closure considerations for various wound types

- Small wounds may be left open to heal by secondary intention with daily non-stick dressing changes until the skin has re-epithelialized.
- Gaping wounds can be approximated and closed after copious irrigation and debridement.
- Wounds to the face from any animal can be closed (for cosmesis and because the face has no higher risk of infection than elsewhere).
- *Feline bites*: Avoid closing all non-facial wounds. Puncture wounds have an especially high risk of infection.
- *Canine bites*: most can be closed except the hands/feet, where infection risk is much higher.
- *Human bites*: avoid closing non-facial wounds or facial wounds >24h after injury. Follow up with a plastic surgeon.

BOX 4: Scenarios where it is reasonable to involve a surgical consultant for managing bite wounds

- Suspected involvement or exposure of vascular structures, nerve, tendon, bone or joint
- Associated fracture
- Partly avulsed tissue with questionable perfusion after replacing in anatomic position
- Tissue loss (including defects and amputations)
- Pediatric patients
- Complex or large wounds
- Injuries that cannot be managed in the urgent care setting (such as wounds requiring general anaesthesia for repair)
- Injuries with risk of cosmetic or functional complications (i.e. large wounds to the face, complex hand lacerations)

BOX 5: Scenarios when antibiotic prophylaxis is reasonable following a mammalian bite.[23,32–35]

- Patients with comorbidities that impair healing, such as immunocompromised states, cirrhosis, asplenia, or diabetes mellitus
- Human bites
- Bites to high-risk areas especially the face, hands, feet, or genitals
- Deep injuries with possible bone or joint involvement
- Crush injury with devitalized tissue
- Puncture wounds (i.e., most cat bites)
- Bite wounds that underwent primary closure

TABLE 1: Bacteriology, infectious concerns and antimicrobial treatment for common mammalian bites

Animal	Pathogens of concern[34,64]	Infection of concern	Antimicrobial regimen
Dogs	Mixed organisms in oral flora with common genus listed Aerobic: <i>Pasteurella</i> (e.g. <i>P. canis</i>), <i>Streptococcus</i> (e.g. <i>S. mitis</i>), <i>Staphylococcus</i> (e.g. <i>S. aureus</i>), <i>Neisseria</i> (e.g. <i>N. weaveri</i>) Anaerobes: <i>Fusobacterium</i> (e.g. <i>F. nucleatum</i>), <i>Porphyromonas</i> (<i>P. macacae</i>), <i>Prevotella</i> (<i>P. heparinolytica</i>)	Bite wound infection	Amoxicillin-clavulanate PO for 5-7 days to treat uncomplicated bite wound infection.
	<i>Capnocytophaga canimorsus</i>	Severe sepsis and purpura fulminans in immunocompromised patients such as cirrhosis or asplenia	Amoxicillin-clavulanate IV or piperacillin-tazobactam IV to treat for sepsis after dog bite
Cats	Mixed organisms in oral flora, with common genus listed Aerobic: <i>Pasteurella</i> especially <i>P. multocida</i> , <i>Streptococcus</i> (e.g. <i>S. mitis</i>), <i>Staphylococcus</i> (e.g. <i>S. epidermidis</i>), <i>Neisseria</i> (<i>N. weaveri</i>) Anaerobic: <i>Fusobacterium</i> (e.g. <i>F. nucleatum</i>), <i>Porphyromonas</i> (e.g. <i>P. gulae</i>), <i>Bacteroides</i> (e.g. <i>B. tectus</i>)	Bite wound infection	Amoxicillin-clavulanate PO for 5-7 days to treat uncomplicated bite wound infection.
	<i>Bartonella henselae</i>	Cat scratch disease: self-limited regional suppurative lymphadenopathy ipsilateral to inoculation site	Azithromycin PO for 5 days for treatment.
Humans	Mixed organisms in oral flora and skin with common genus listed Aerobic: viridans <i>Streptococcus</i> (e.g. <i>S. anginosus</i>), <i>Staphylococcus</i> (e.g. <i>S. aureus</i>), <i>Eikenella</i> especially <i>E. corrodens</i> Anaerobic: <i>Fusobacterium</i> , <i>Prevotella</i> , <i>Veillonella</i>	Bite wound infection	Amoxicillin-Clavulanate PO for 5-7 days to treat uncomplicated bite wound infection.

	Bloodborne pathogens: Human immunodeficiency virus (HIV) Hepatitis B virus, hepatitis C virus	Chronic viral infection	The risk of transmission through bites such as HIV is very low.[52] Post-exposure prophylaxis is considered on a case-by-case basis.
Monkeys	Mixed organisms in oral flora with common genus listed Aerobic: <i>Neisseria</i> (e.g. <i>N. subflava</i>), <i>Streptococcus</i> (e.g. <i>S. mitis</i>), <i>Haemophilus</i> (e.g. <i>H. parainfluenzae</i>), <i>Eikenella</i> especially <i>E. corrodens</i> Anaerobic: <i>Fusobacterium</i> (e.g. <i>F. nucleatum</i>), <i>Bacteroides</i> (e.g. <i>B. fragilis</i>), <i>Peptostreptococcus</i> (e.g. <i>P. micros</i>)	Bite wound infection	Amoxicillin-clavulanate PO for 5-7 days to treat uncomplicated bite wound infection.
	<i>Cercopithecine herpesvirus 1</i> (<i>herpes simiae</i> or <i>B virus</i>) from bites or scratch by macaque monkeys	Can result in fatal encephalitis	In high-risk cases, post-exposure prophylaxis with valacyclovir PO for 14 days[65]
Rodents	<i>Streptobacillus moniliformis</i> more common in North America <i>Spirillum minus</i> more common in Asia	Rat bite fever: fever, myalgia, migratory arthralgia, polyarthrits, maculopapular rash that erupts over palms, soles and extremities.	Penicillin G IV then step down to PO for total of 14 days as treatment[66]
Sheep, goats	Orf virus acquired from contact with an infected animal	Solitary papule or nodule that undergo several stages. It may initially drain and then become firm and crusted. Later, the papule or nodule can have a	Usually self resolves in 6-8 weeks. Monitor for complications such as secondary bacterial infection.[67]

		papillomatous surface and will regress.	
Other mammals	Similar to dog and cat bites, the oral flora is polymicrobial that includes aerobes and anaerobes. Some pathogens of note are listed below: Horses, cows: <i>Actinobacillus ligieresii</i> , <i>A. suis</i> Camels: <i>Pseudomonas aeruginosa</i> [68] Pigs: <i>Pasteurella aerogenes</i> , <i>A. suis</i> In general, the organisms from oral flora are typically covered by the same antibiotic for dog and cat bites.[34] The exception is <i>P. aeruginosa</i> in camel bites.	Bite wound infection	Amoxicillin-clavulanate PO for 5-7 days to treat uncomplicated bite wound infection. Consider adding coverage for <i>P. aeruginosa</i> in camel bites (e.g. ciprofloxacin PO)

BOX 6: Reasons to consider rabies post-exposure prophylaxis [25,37,69,70]

High risk scenarios where rabies PEP is usually *indicated* [25,69]

- Animal identified as suspected, probably or confirmed to be infected with rabies
- Direct contact with a bat especially if a bite, scratch or exposure of saliva into a wound or mucous membrane has occurred

Low risk scenarios where rabies PEP is typically *unnecessary* [25,69,70]

- Dogs, cats and domestic ferrets that are healthy on assessment and after 10 days of observation
- Animal bites acquired in an area confirmed to be free of terrestrial rabies based on surveillance
- Bites by small rodents (e.g. squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, and mice) and lagomorphs (rabbits and hares), because these animals are not known to transmit rabies to humans

Additional factors that lower the threshold for giving PEP: [25,37]

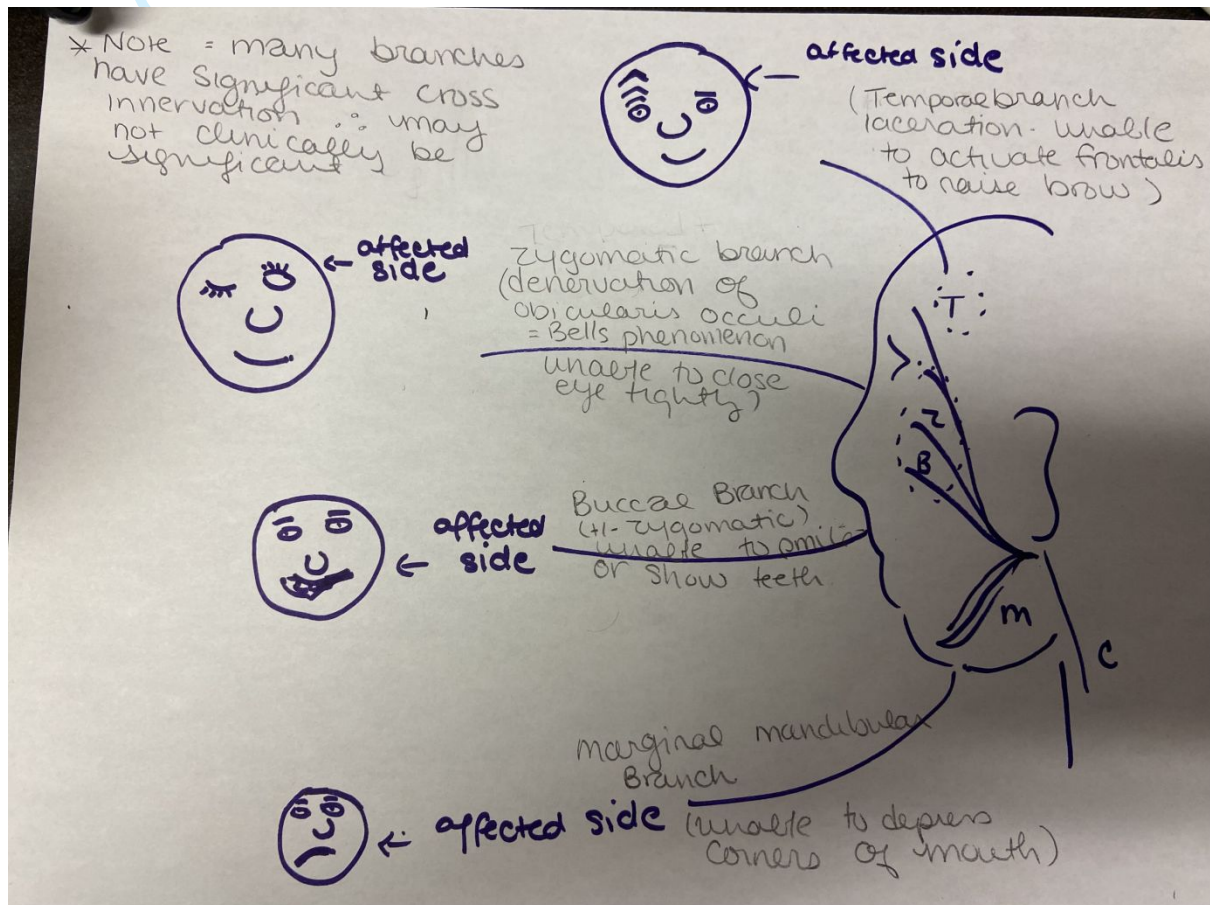
- Rabies is locally endemic
- Young children
- Serious bites (transdermal with bleeding, multiple, location on head/neck or extremities)
- Biting animal is higher risk: species with high local carrier rates, wild/stray animals, or aggressive behaviour (e.g., unprovoked bites)
- Animal unavailable for observation or testing

BOX 5: Scenarios where it is reasonable to involve an infectious diseases expert[32]

- Patient is systemically unwell or has signs of sepsis
- Patient has a severe infection involving deep tissues or a rapidly progressive infection
- Patient developed an infection despite antibiotic prophylaxis
- Progressive infection despite appropriate oral antibiotics
- The culture grows organisms that are unfamiliar to the practitioner

FIGURE 3: Acute facial nerve deficits. Note all images show an intact right side and an affected left side.

For the illustrator



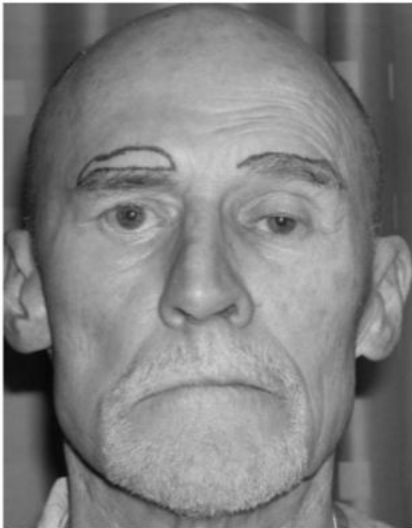


Figure 5 Loss of frontalis function leads to brow ptosis, which can obstruct the visual field. This patient is marked for a direct brow lift on the right side. (From Neligan PC, Wei F-C. Microsurgical Reconstruction of the Head and Neck. St. Louis: Quality Medical Publishing, Inc.; 2009.)



Figure 3 An intact Bell's phenomenon on the patient's right protects the cornea despite inadequate lid closure.

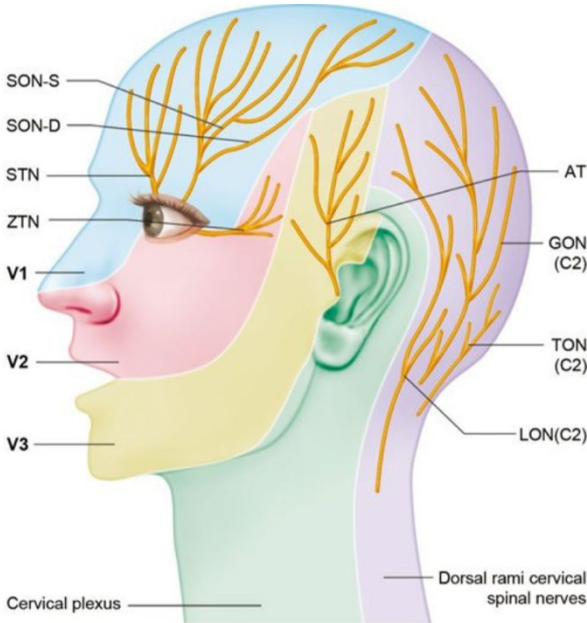
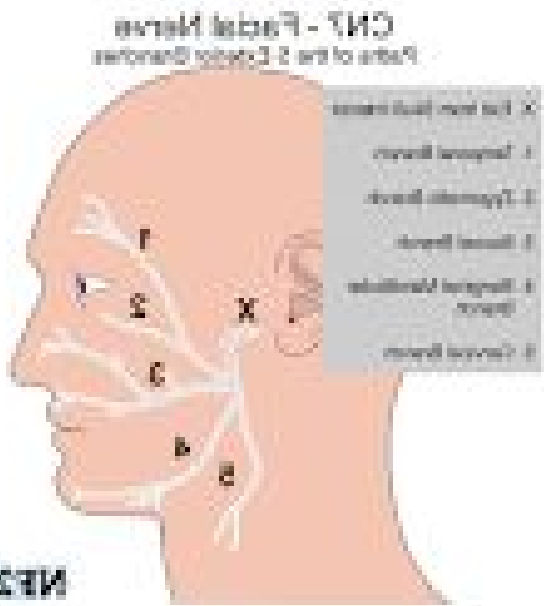


Fig. 10.1 Sensory distributions of nerves involved in migraine trigger points: AT, auriculotemporal nerve; GON, greater occipital nerve; LON, lesser occipital nerve; SON-D, deep branch of the supraorbital nerve; STN, supratrochlear nerve; TON, third occipital nerve; SON-S, superficial branch of the supraorbital nerve; V1, ophthalmic branch of the trigeminal nerve; V2, maxillary branch of the trigeminal nerve; V3, mandibular branch of the trigeminal nerve; ZTN, zygomaticotemporal nerve.

FIGURE 2: Tenodesis can help differentiate a tendon injury from nerve injury or pain-related guarding when a patient cannot move their fingers after an injury. With the limb fully relaxed, flexion at the wrist normally extends the digits (left side of image) and extension of the wrist flexes the digits (right side of image). Fingers will follow this pattern in the presence of nerve injury, but not in the presence of (complete) tendon laceration. It is still necessary to consider sensation in distal nerve distribution to be able to rule out nerve injury if the laceration involves or crosses the course of a major nerve. Diagnostic sensitivity and specificity of this manoeuvre are not known. (figure from article doi: 10.1016/0363-5023(92)90371-u, to be used as the basis for illustration by BMJ illustrators.) *TO THE ILLUSTRATOR:* can we provide two separate images, showing superimposed what injury would look like, with labels? Specifically, the left side of the image [with wrist flexed and fingers extended] would have a superimposed flexed index finger with the labelling complete extensor tendon laceration. The right side of the image [with wrist extended and fingers flexed] should have the index finger mostly extended, with the labelling complete flexor tendon laceration.)

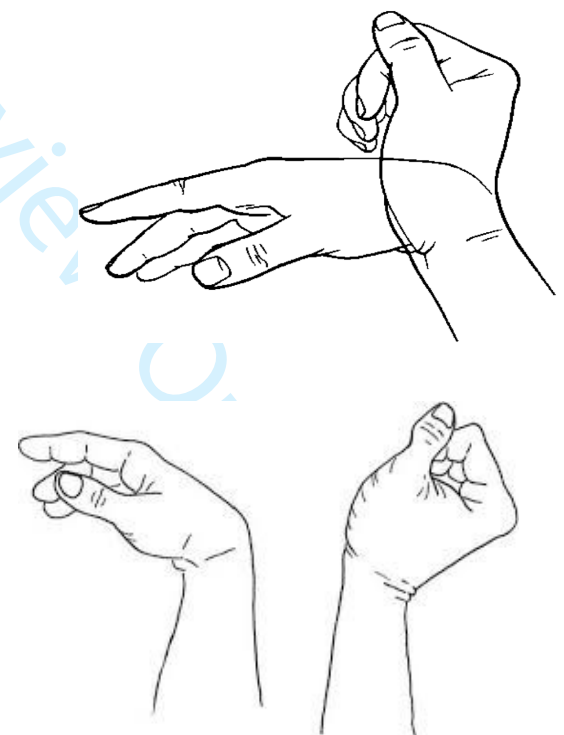
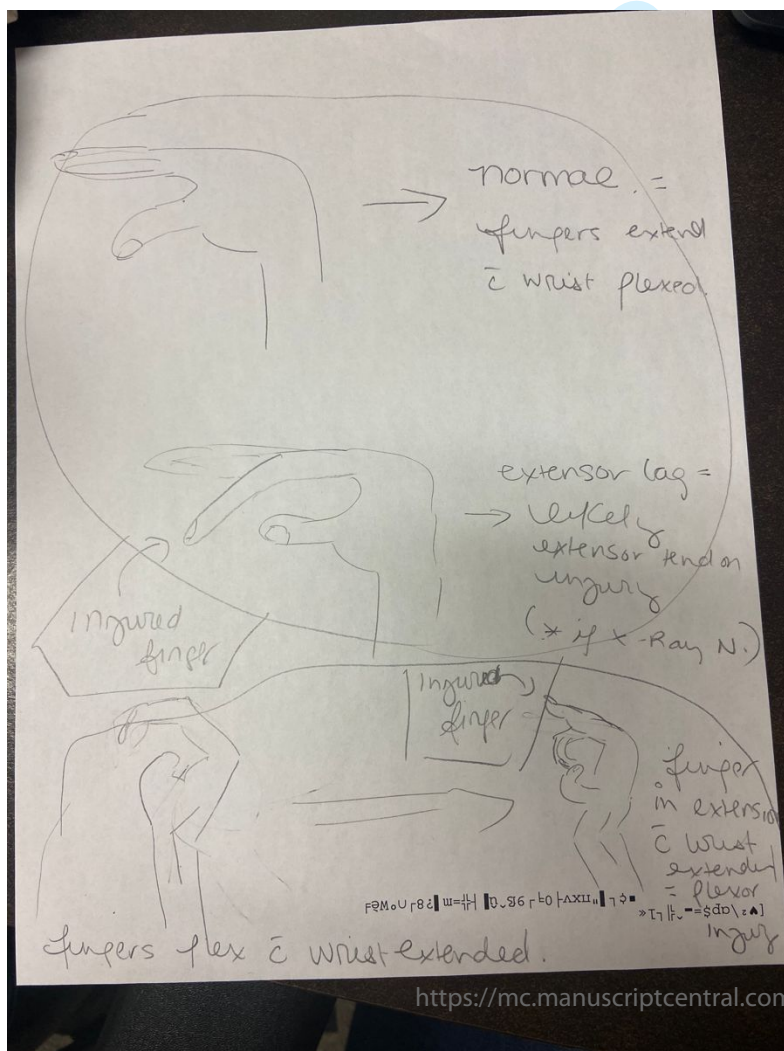
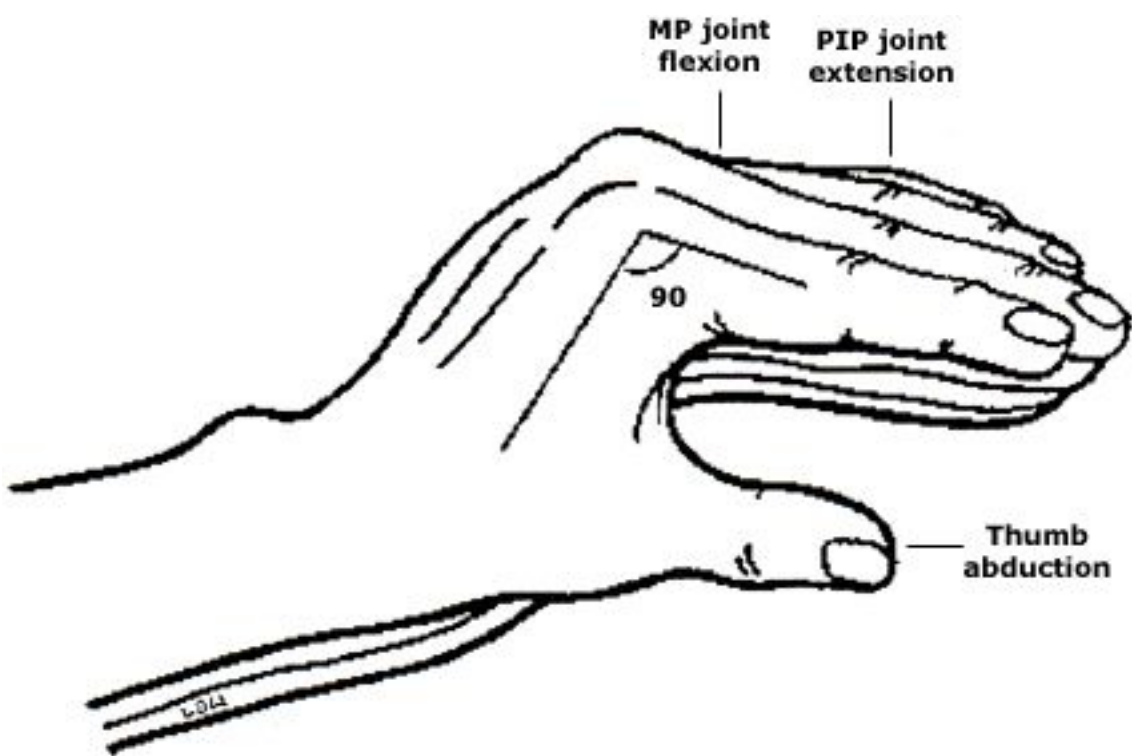


FIGURE 2: position of safety



The safe position shows the wrist extended 20 degrees, MCP joints flexed at 90 degrees, and the PIP and DIP joints fully extended.

MCP: metacarpophalangeal; PIP: proximal interphalangeal; DIP: distal interphalangeal.

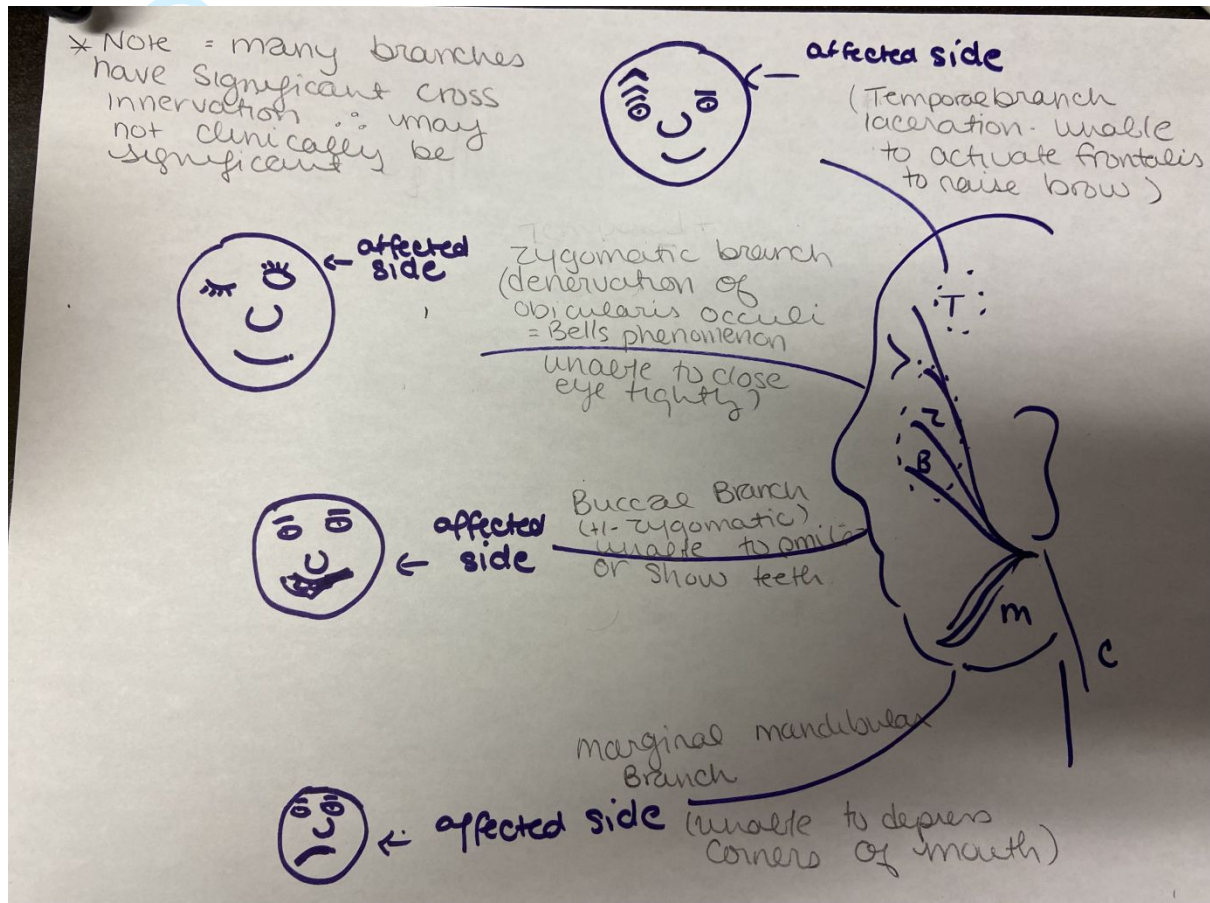
Reproduced with permission from: Harrison, BP, Hilliard, MW. Emergency department evaluation and treatment of hand injuries. Emerg Med Clin North Am 1999; 17:793. Copyright © 1999 Elsevier.

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Image source: <https://www.uptodate.com/contents/image?imageKey=PEDS%2F60552>

FIGURE 3: Acute facial nerve deficits. Note all images show an intact right side and an affected left side.

For the illustrator



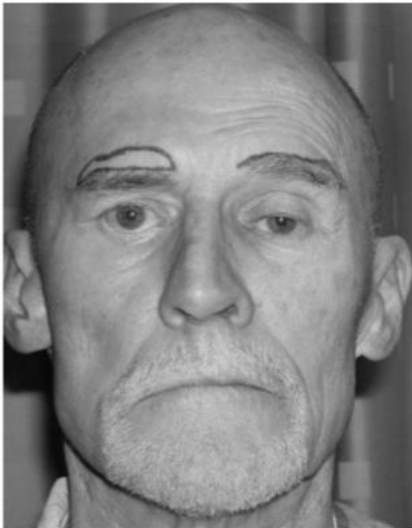


Figure 5 Loss of frontalis function leads to brow ptosis, which can obstruct the visual field. This patient is marked for a direct brow lift on the right side. (From Neligan PC, Wei F-C. Microsurgical Reconstruction of the Head and Neck. St. Louis: Quality Medical Publishing, Inc.; 2009.)



Figure 3 An intact Bell's phenomenon on the patient's right protects the cornea despite inadequate lid closure.

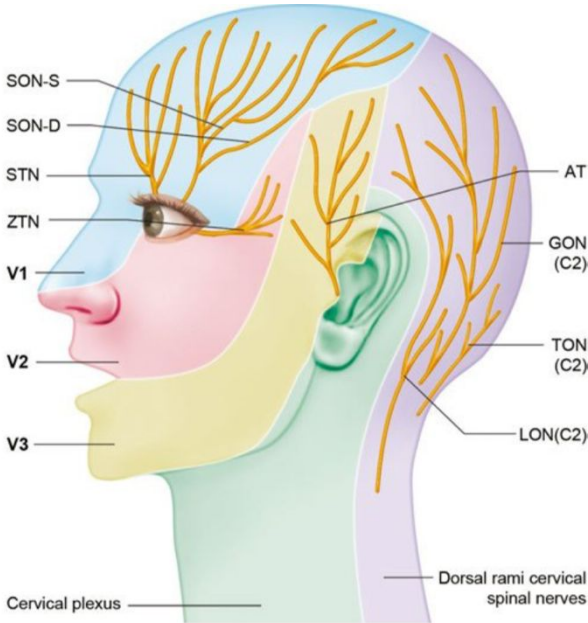
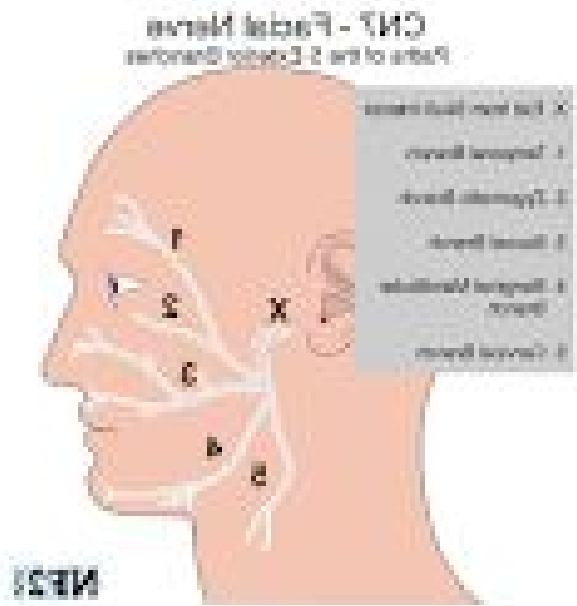


Fig. 10.1 Sensory distributions of nerves involved in migraine trigger points: AT, auriculotemporal nerve; GON, greater occipital nerve; LON, lesser occipital nerve; SON-D, deep branch of the supraorbital nerve; STN, supratrochlear nerve; TON, third occipital nerve; SON-S, superficial branch of the supraorbital nerve; V1, ophthalmic branch of the trigeminal nerve; V2, maxillary branch of the trigeminal nerve; V3, mandibular branch of the trigeminal nerve; ZTN, zygomaticotemporal nerve.