

DOG BITE WOUNDS TO THE MOUTH IN PRIMARY CARE: FROM SUCCESS TO FAILURE - A REVIEW

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Abstract

In this study, 54 articles on oral and facial dog bites and illustrations of 3 patients are reviewed.

Firstly, wounds in general are considered, secondly non-extrapolated, updated world epidemiology (USA and Canada, India, Tanzania, Italy, United Kingdom, Colombia, Peru, Argentina, Australia, Switzerland, Austria and Spain) on rates of bite per population of dog attacks will be studied and then some specific types of wounds, in particular, dog bite injury to the mouth area, are considered. The third section deals specifically with face wounds. Fourthly, the medical treatment of dog bite wounds is described, including rabies and tetanus prevention and antibiotics, and surgical approaches: sutures, wound care and instrumental interventions in a dentistry or medical setting and complications with two examples: those treated in the hospital and in an outpatient setting, before and after. The anatomy, legislation, controversies and races of dogs are discussed. The ultimate aim is to determine when a patient with a special injury should be referred to hospital, according to the principle: *primum non cedere*. The aim of this article is help dentists and physicians to clarify this question, following the explanations provided in four tables and three pictures.

Keywords:

oral dog bite, legislation, complications, surgical technique, *Pasteurella multocida*, mammalian.

Introduction

Dentists and general practitioners are frequently unsure if they should close a particular type of injury or not, or if they should refer the patient to the hospital.

Although basic training in dentistry and medicine may be sufficient, there are some problems that come down to experience. Due to the increasing number of dangerous dogs because of the increase in aggression in society and the number of lawsuits for negligence, there is a need for this study, starting with a brief review of the *types of wounds*: a) by agent, shooting, incised or lacerations and blunt wounds such as bites or star-shaped wounds and b) by time: more than 3 hours with risk of contamination in diabetics, presence of dirt, a blunt or oral bite and more than 12 hours with resulting infection. The races of dangerous dog in Spanish legislation have the common characteristic of being muscled animals, with short hair, weighing over 20kg with large and strong jaws, a wide chest and sturdy legs. These animals have created an aura of aggression but this probably depends more on their training than their nature. In Spain, aggressive dogs include the Akita Inu, Tosa Inu, Rottweiler, Presa Canario, Pitbull Terrier, Staffordshire Bull Terrier, American Staffordshire Terrier, Dogo Argentino, Fila Brasileiro, their crosses and dogs that have these features in terms of physique and character or that have attacked people or other animals, including our first case (Fig.1), a boxer, our second (Fig.2), a mongrel and our third, a small dog (Fig.3). These characteristics are reflected in the "Spanish Royal Decree 287/2002" regarding the legal regimen for ownership of potentially dangerous animals. In the UK, this is the "Dangerous Dogs Act 1991" and in Germany, the "Act for handling and control of dogs in Berlin, September 29, 2004". However the current trend is in favor of legislation that holds individual dog owners responsible for their dog's behavior. The most attacks by a race of dog per population occurs with the American Staffordshire Terrier and among small dogs with the Fox Terrier. It is remarkable that the incidence of dog bite is not markedly reduced by legislation restricting or preventing the ownership of certain breeds of dog. Upon written complaint, the judge will clarify what should be done with the animal, which, in case 1 was separation from humans

(Fig.1) and in case 2(Fig.2), the dog was euthanized by its owner. If the animal is not likely to be infected with rabies(1), receipt of laboratory tests which takes two days should be awaited. If the animal was not vaccinated then it should be kept in quarantine for 10 days and if the disease appears, the victim should be treated with serum and vaccine(2). To own potentially dangerous dogs, a special license is needed in different regions and countries(3), and a series of requirements and safety measures must be respected. Not all countries have records of dog attacks. These are reflected in Table 1. In USA and Canada in 2001, an estimated 68 million dogs were kept as pets(14,15) (Table 2). In most cases, injuries are minor(16). The head and neck (H&N) area is involved in 77.2% cases in children(18). These injuries can produce stress disorders(19), and mainly involve the lips, nose or cheeks(4,20) with a high risk of infection because there may be occult communication with the oral cavity in dog bite injuries to the cheek, due to the nature of the dog's occlusion and the presence of the relatively avascular buccal fat pad, that is very developed in children and which, once exposed, resists infection poorly(21,22). Frequently the attack is unprovoked by the victim(13,18,23) and the dog is familiar to the victim. These wounds should be closed primarily because in this way the most favorable aesthetic results are achieved(21). Wounds include lacerations, tears(11), avulsion, communication with the oral cavity, puncture and abrasions



Fig1-Patient with a non-hospital injury type I(lip) and II(cheek), before and after, produced by the patient's own mixed race dog.

The aim of this publication to alert dentists and physicians to the high frequency of dog bite to the mouth area, showing the need for continuing surgical education, clarification on when to refer a patient with a particular injury to the hospital instead of applying a quick primary suture in the clinic, benefits and disadvantages, complications, an update on the treatments and an overview of case-based medicine in the field.



Fig2- Patient with partial loss of lower lip caused by the patient's own Boxer. Postoperative and after 7 days.

Material and methods

Firstly, a lack of extrapolation and high official worldwide rates of dog bite (3-18) were observed in a review of journals indexed in *pubmed*, paying special attention to oral cases (18-21) and causes(13,22,23), in order to highlight the importance of this pathology and draw attention to the need for continuous training in general healthcare. Secondly, the complications encountered by the various authors were studied (4,11,21,24,29,31,35-42) and an online search was made for the following keywords: infection, dehiscence, keloids, complications. In third place, the different treatments(1,2,13,21,25-27,29-32,42-45): non-suture, silk, adhesive strips, staples, monofilament or absorbable sutures and special injuries. Finally, illustrations with photographic material taken in our department are provided and a review is made of the different kind of injuries that are closed in hospital (13,22,41,42): conservative debridement, key points, preferred



Fig3. An example of key point in the upper lip in a young patient with a blunt injury from a small dog that was in arms.

sutures, lip locking, V-Y advancement, flat surface, elastic flap, skin grafts, Abbe and Yu flaps, free microsurgical graft and face transplant. Cases from more than 16 years ago excluded [with the exception of classic papers such as Lackmann(1992)] and only oral and facial cases are included, especially all the recent articles from 2012. Articles describing real complications were selected by time and variety of treatments, to help the reader make the best choice.

| Country | bite/ 100.000/ year | Treatment required | Facial | Hospitabl e | Breed | Author | Year of study |
|----------------------------|---------------------------|-----------------------|-----------|------------------------|-------------------------|--------------------|------------------|
| Argentina | 23 | - | - | - | - | Pasteur(Arg) | 1998 |
| B. Aires | 174 | - | 42-70% | 651 | - | Ministry of.Health | 2000 |
| TierraFuego | - | - | 11%(H&N) | 8,1% | - | Zanini | 2008 |
| Switzerland | 192,5 | 52% | - | 4,7% | PitBull | Matter | 2007 |
| Italy | 132-152 | - | - | - | - | Ostanello | 2000-2002 |
| | 58,4 | - | 9,5%(H&N) | - | - | Ostanello | 2000-2002 |
| Tanzania | 0,0104 | - | - | - | - | Laud | 2002 |
| Peru | - | - | - | - | - | - | - |
| Lima(Child) | 23.5 | 100% | 80% | 206 | Mixed | Morales(4) | 1995-2009 |
| Australia | 155 | - | - | 13.000 | - | Thompson(5) | 1991 |
| Adelaide | 650 | 2600 (40%) | - | 7,3/10.000 810(13%) | German-Shepherd | SAHCISS & SAHOS | 1990-1993 |
| Colombia | 4957 | - | - | - | - | Paez&Cediel(6,7) | 2001-2006 |
| India | - | - | - | - | - | - | - |
| Dayalpur | 0,257 | - | 8%(H&N) | 50% | - | Agarwal(8) | 2002 |
| Austria (Child) | 50 | 27% | 50% | - | Mixed Bologne | Schalamon(9) | 1994-2003 |
| USA & Canada | 323-646 | 333.700(3,10,11) | 44.000 | 1/10.000 | PitBull | CDC(13) | 1994 |
| | 1452 |) | - | 31.000(12 | - | CDC | 2006 |
| Pittsburg | 0,6 | 885.000 | - |) | - | Chang | 1993 |
| GelphCity | 160 | - | 19,7% | - | Mixed | Szpakowsky(3) | 1986-1987 |
| | - | - | - | - | - | - | - |
| Spain(Child) | - | - | - | - | GermanS | H.JuanCanalejo(1 | 1991-2000 |
| ValenciaReg | 91,3 | - | - | - | GermanS | 6) | 1995-2004 |
| Aragon | 84,1 | - | 9% | - | GermanS | Leon Rosado(17) | 1995-2004 |
| UK | - | 230.000 | - | - | German-Shepherd | Baxter(18) | 1984 |
| Thanet | 0.03 | 6% | 11%(H&N) | 0 | - | Thomas | 1989 |

Table n°1. Official statistics of bite dog in some countries.

Results

All authors conclude that the circumstances of the injury must be determined: etiology(13,22,23), dirt, treatment, time since bite, antibiotic allergies and associated complications (Table 3)(24). Then, orofacial wounds that can be sutured by generalists (*type I*) mus

| Breed | Attac | %/dogs |
|-----------|-------|---------|
| Akita | 65 | 0.06% |
| Akita mix | | 8 |
| Airedale | | 2 0.04% |
| Beagle | 2 | 2.3% |

| | | |
|-----------------------|------|--------|
| Belgian shepherd | 7 | 0.03% |
| Border collie | 2 | 1.2% |
| Boxer | 50 | 0.08% |
| Boxer mix | 8 | |
| Briard | 2 | 0.03% |
| Brittany spaniel | 4 | 0.03% |
| Bulldog (English) | 20 | 0.05% |
| Bull mas(PresCanario) | 82 | 0.04% |
| Bull mast mix | 5 | |
| Bull terrier(not pit) | 3 | |
| Cane Corso/Itali mast | 13 | 0.02% |
| Chihuahua | 1 | 0.07% |
| Chow | 55 | 0.01% |
| Chow mix | 14 | |
| Cocker spaniel | 1 | 1.2% |
| Collie | 4 | 2.2% |
| Coonhound | 2 | 0.06% |
| Dalmatian | 3 | 1.0% |
| Dachschund | 6 | 1.0% |
| Doberman | 15 | 1.3% |
| Dogo Argentino | 3 | |
| Fila Brasiero | 1 | |
| German shepherd | 96 | 2.3% |
| German shepherd mix | 57 | |
| Golden retriever | 11 | 1.4% |
| Great Dane | 33 | 0.03% |
| Greyhound | 1 | 1.6% |
| Husky | 71 | 0.05% |
| Jack Russell terrier | 5 | 0.05% |
| Labrador | 48 | 1.0% |
| Labrador mix | 22 | 0.06% |
| Malamute | 13 | 0.05% |
| Mastiff | 22 | 0.08% |
| Mix(other) | 309 | |
| Old English sheep dog | 2 | 0.06% |
| Other | 59 | |
| Pit bull | 2218 | 4.4% |
| Pit mix | 141 | |
| Pomeranian | 1 | 1.4% |
| Poodle | 4 | 2.8% |
| Rhodesian ridgeback | 2 | 0.04% |
| Rottweiler | 493 | 2.2% # |
| Rottweiler mix | 28 | |
| Saint Bernard | 11 | 0.08% |
| Sharpei | 5 | 0.03% |
| Shih Tzu | 1 | 1.2% |
| Unidentified | 10 | |
| Weimaraner | 2 | 0.08% |
| West Highland terrier | 2 | 0.04% |
| Wheaten terrier | 3 | 0.02% |
| Wolf hybrid | 84 | |

Table n° 2. Rate of deep bites per race of dog and per population. Modified from table of Dog attack, deaths and

be selected (Table 4) (Fig.1) (25). When the decision is made to suture, aseptic measures must be taken, with the administration of antibiotics in contusion wounds(26), in those occurring more than 3-6 hours ago, festering wounds and those in contact with saliva, and administration of a tetanus vaccine(13,21). It is important that treatment is initiated rapidly, using local anaesthetic far from wound or nerve blocks, disinfection, washing and brushing and debridement(27), but avoiding removal of any small areas of healthy tissue, as mentioned by Moreira(28), haemostasis and finally suture. In *mucosa*, absorbable sutures with number 4/0 in gum are less predictable according to Leknes, but the best, according to most authors. The worst is silk (29), although it is more flexible. Monofilament is the best for avoiding an inflammatory reaction, according to Mirković (30). In *skin*, most authors prefer monofilament, although closure is more difficult, with the exception of Parell who prefers absorbable(31) and other authors such as Smith, Morgan and Gouin who prefer non-suture(18) or use adhesive strips(32,33) and must be covered with a dressing for two days. Tissue adhesives can be used on children's skin as mentioned by Beam (28,34) and in small wounds, avoiding anaesthesia although are not useful in mucosa(32,33) applying more than three layers with thirty seconds between them and sixty seconds at the end, or staples(28,35). If the wound is big, general anaesthesia in hospital may be needed (25). To close injuries in a dentistry or medical consulting room, basic instruments are needed: Tweezers (thin), haemostatic clamps, dissecting scissors (short, thin, curved and blunted), needle holder with flat area (to avoid damaging the exit wounds or the needle), separators and anaesthetic and washing syringe.

- Facial paralysis(35).
- Breaking of gland ducts(35,36).
- TMJ(37).
- Jaw fractures(38,39).
- Whiplash(40).
- Cranial fracture(41).

Table n° 3. Possible complications associated with oral dog bite.

Surgical technique depends on the type of wound (Table 4). According to Lanckmann, in a child, an attempt can be made to suture in the consulting room, even type II (Fig.1)(25) although it is preferably performed in the operating theatre. Although primary closure of head and neck wounds is performed with antibiotic prophylaxis(27) according to Bradley and Lackmann, it is associated with a very low risk of infection(1%) and is always performed from the inside out. In the mucosa, Sylverstein(42) prefers single, discontinuous stitches from mesial to distal, from mobile to fixed mucosa and positioning of the key point (it is very important to approach the vermilion border of the lip correctly to avoid a stepped effect), without tension. It must remain in place for more than 5 days(42). In the *tongue*(28,42,43), if it is not bleeding, suture is not necessary and treatment consists of drinking cold fluids and not rinsing or spitting the first day, and the next two days rinsing with chlorhexidine and eating soft food. If bleeding starts, it should be swabbed with gauze. It can be dangerous if it occurs on the *floor of mouth* because a hematoma may block the airways but possible injury of the submaxillary ducts(35,36) is not very important. The *hard palate*(42,43)

- I. Superficial injury without muscle involvement.
- II. Deep injury with muscle involvement and full thickness injury of the cheek or lip with oral mucosa involvement (through-and-through wound.)
- III. Complete avulsion with exposing of deep structures.
- IVA. Deep injury with severed facial nerve and/or vascular.
- IVB. Deep injury with concomitant jaw fracture or organ.

Table n° 4. Classification of orofacial dog bite injuries in children(24) .

need only be sutured if it is bleeding or pierced and in the *soft palate*(42,43) if it extends through the free side margin, according to O'Sullivan. Children with lacerations of the gum margin (eg. degloving injury) need to be referred for debridement and repair under general anaesthesia(43) although as Moreira states, injuries of less than 2cm heal without repair. If it is a *special case*, involving for example, loss of tissue and the corners of the mouth are involved (Fig.3), near the temporomandibular joint or bone(37,38,39) or if there is whiplash(40), more than 24-48

hours(25) have elapsed (particularly in the lips), a waiting period of 4 to 5 days with antibiotics is required before definitive wound closure(21) to avoid the rapid spread of cellulitis [edema, pus, lymphadenitis or fever(4,11)] or signs of sepsis, in particular *Pasteurella multocida* sepsis(11,21,44). Host risk factors include the extremes of age, diabetes mellitus, chronic renal failure, obesity, malnutrition and immune system disorders or therapies such as corticosteroids and chemotherapeutic agents that can produce the appearance of hypertrophic scar(45), above all in very young patients. Infected injury, human adult bite, firearms, avulsion wounds, facial paralysis or involvement of Stensen ducts (but not if involvement is below the line that joins the angle of jaw with the nose) or parotid gland(35,36) involvement are other special injuries that must be referred to the hospital.

Injuries (Figs.2,3)(22) that should be referred to hospital should be sent with temporary wound care with compression with swabs to achieve haemostasis, maintaining vital signs and accompanying the patient or calling the emergency services if needed, because fatalities can occur from carotid injury and are associated with attacks by Pitbull Terriers, Rottweilers and German Shepherds, and even Jack Russells(46).

Treatment can be complicated with necrosis, keloids, dehiscences, steps, tetanus or persistence of foreign bodies diagnosed by Xray(13) which may need complex surgery if the patient becomes unwell.

Hospital treatment consists of: 1) direct closure (Fig.3), whenever possible and immediately after thorough wound cleaning, brushing and conservative debridement(27) with, preferably, general anesthesia, depending on the case and anesthesia trunk in a relatively aseptic environment, taking into account the key point(47)(Fig. 3) in the mucocutaneous junction. Monofilament is preferred(30) if the edges are contused to prevent tearing. 2) Lip-locking wedge(28). Loss of substance in elderly patients with sagging lip should be sutured in a specialized center with anesthesia trunk. 3) Local flaps(48): a)from V-Y advancement is used by Sand(49), as in case 2, which is a middle-aged patient with loss of substance in the skin from the vermilion line mucosa, designing a V with the vertex towards the lower lobby and ends coinciding with the edges of the wound, deeper into the submucosa. The lower part is partially released, even up to half of the flap (best overcorrect by volume), the vertex that is the area which is tightened with the advancement and the material is advanced to close the defect, subsequently closing the wound lobby, leaving aspect of Y, using absorbable suture in depth and 5/0 silk. Anesthesia trunk can also be made; b) From mucosa, for use on a flat surface as above but in surface defects; c) Elastic for the offvermilion mucocutaneous junction as reported by Rifaata(50) for preserving the coronary artery and stretching to close the defect. The only drawback is that it requires general anesthesia. 4. Skin grafts(25). Notice the aesthetic difference in color, texture and volume, but surgery retractions could be prevented in a second preferably taking it the same surgical area as the supraclavicular region, with local anesthesia. 5.Regional flaps(25): Abbé flap or Karapandzic for defects between 1/2- 1/3(50) and Yu flap, as reported by Lopez, in more than 50%(51) and lateral and buccal fat flap from small to medium (Alkan)(52). 6.Microsurgical flaps(53). Microsurgical suture, region-amputated, forearm free flap, anterolateral thigh flap and finally, as shown by Siemionov, face-transplant(54).

Conclusion

If there is no loss of substance, in skin, direct suture in layers with monofilament with conservative debridement(40) and absorbable sutures in mucosa and if it is <0.5cm in the vermilion or the rest of the oral mucosa without cutting the free edge of soft palate and is not bleeding, it could be appropriate for 2nd intent closure, being treated by the generalist. If there is little loss of substance (<1/3 of the lip), it can will be reconstructed with local flaps (V-Y advancement, mucosal or elastic) as the case 2 after closing the wedge, if there is minor aesthetic impact made in two stages to avoid shrinkage, using a graft and if the loss is greater than 1/3 and there are amputations it would be indicated from the regional and local flaps, including microsurgical reconstruction, in hospital. Between them, some deep injury with muscle involvement can also be treated in consulting room setting and that is why I introduce hospital treatment in this study. The most common situation in developed countries could be due to a higher record retention(Example Peru-Austria). In conclusion, the most important is trying to do the best to heal injuries and to avoid heroism, to know our limits, the cases of lost tissue injury, apply a dressing and send the patient to the hospital, achieving success(fig 1,2,3) and avoiding the failure.

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