

Maxillofacial bite injuries treatment – 20 years experience

Research Article

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Abstract: Management of bite injuries of the face is a part of everyday maxillofacial practice. The aim of the paper was to evaluate the bite injuries in the maxillo-facial region and to recommend treatment protocols. Materials and methods: The study was performed as a retrospective analysis of the medical records of University Clinic for maxillo-facial surgery in Belgrade. A total of 408 patients were treated for bite injuries of the maxillofacial region according to the same surgical protocol. Results: Animal bite injuries (92.9%) were much more common than human bites (7.1%). Dog bites (98.9%) were almost exclusive among animal bite injuries. Young males (58.7%), children and adolescents (44%) are predominately involved. The most frequently injured facial structure were lips (49.2%). Human bites presented in young males (86.2%), resulted from physical conflicts (58.6%) mostly affected cheeks (50%). Majority of injuries were Lackmann's Class I and II. Conclusions: There were no reported infections or other complications after treatment with no need for secondary reconstruction. Factors that contribute to a good clinical outcome are: stage of the injury; short time interval from the injury to the admission into the hospital; no infection signs on admission; adequate surgical protocol with antibiotic prophylaxis.

Keywords: Dog bite • Human bite injuries • Maxillofacial region • Treatment protocol

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1. Introduction

Management of bite injuries of the face is a part of everyday maxillofacial practice.

Literature data indicate a significant number of animal bite injuries in humans. It becomes a major problem of contemporary world regarding the consequences of injuries and economic costs of their treatment [1,2]. Animal bites are commonly caused by accident and are mainly from dogs and less from other domesticated or wild animals [3,4].

Dog's teeth cause wounding of various body parts, including the maxillofacial region [1,5,6]. Dog bites can result in different types of injuries of the facial soft tissues – excoriations, punctures, lacerations, avulsions,

all of which occur most commonly at prominent parts of the human face. If the dog bites were fueled with high force, bones and large blood vessels can be affected together with surrounding soft tissues. In those cases, the consequences of the injury might turn fatal, though that was reported rarely [6-9]. Human bite injuries in the maxillofacial region can be self-inflicted or originating from another person's teeth. Human teeth may cause lacerations, punctures and soft tissue avulsions. Self inflicted bite injuries are most common at tongue, labial or buccal mucosa. They are often resulting from falls and impacts of the face on a solid surface. These injuries can occur in accidents in sports activities, children's play, etc. Human bite injuries caused by other person are often due to assaults. They occur in physical

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conflicts and sexual assaults, most frequently affecting prominent facial parts [5,10].

Majority of the human and animal bite injuries represent isolated injuries of soft tissues.

Having in mind that these injuries could be burdened by primary infection of the oral microorganisms that, if extensive, may impair the function and esthetic appearance, the treatment poses a particular challenge to maxillo-facial surgeons [11].

The aim of the paper was to evaluate the bite injuries in the maxillo-facial region and to recommend treatment protocols.

2. Materials and methods

The study was performed as a retrospective analysis of the medical documentation archived at the Clinic for maxillo-facial surgery, School of Dentistry, University of Belgrade, Serbia. Included were 20 years period (1989–2009) data of bite injuries of the face in outpatients and hospitalized patients.

The following parameters were analyzed: (a) prevalence of dog and human bite injuries; (b) prevalence of self-inflicted and bite injuries by an assailant; (c) gender distribution among patients; (d) age distribution in the sample; (e) prevalence of bite injuries in relation to their origin (f) prevalence of injuries according to anatomic localization; (g) classification of severity of the wounds based on Lackmann's classification: I–superficial injury without involvement of muscle, II–deep injury with involvement of muscle, III–deep injury with involvement of muscle and tissue defect, IVa – stage III in combination with vascular or nerve injury, IVb–stage III in combination with bony involvement or organ defect, (h) time interval from the injury to the admission into the hospital; (i) type of the surgical procedure undertaken; (j) complications following surgeries.

3. Results

During the observed twenty years period, a total of 408 patients with bite injuries in the maxillo-facial region have been treated. In 379 patients (92.9%), injuries originated from animal attacks. In twenty-nine patients (7.1%) injuries were from human bites.

3.1. Dog bite injuries

Data analysis of the animal bite injuries has confirmed that in the vast majority of cases bite injuries were from canine teeth in 375 (98.9%) cases. Other animal

bites were much less frequent (horse bite in two cases (0.5%), cat bite in one case (0.3%) and pig bite in one case (0.3%), respectively).

Regarding the gender of injured patients, canine bite injuries were more frequent in men – 220 patients (58.7%) compared to 155 women (41.3%). The patient groups including young children and youths less than 20 years age were most frequently injured. (Figure 1).

All dog bite injuries have been accidental. There were no injuries that have resulted from a guide dog's attack. All dogs' bite injuries were localized in facial soft tissues without involvement of the facial bones. There were no lethal outcomes.

Analysis of localization of the injuries has revealed that in 74 patients (19.7%) two or more facial regions have been affected by the injury. More commonly, dog bite injuries have been localized in only one part of the face – in 301 patients (80.3%). The most frequently injured facial structure were lips – in 148 patients (49.2%), cheeks in 63 patients (20.9%) and nose in 37 patients (12.3%), respectively. (Figure 2).

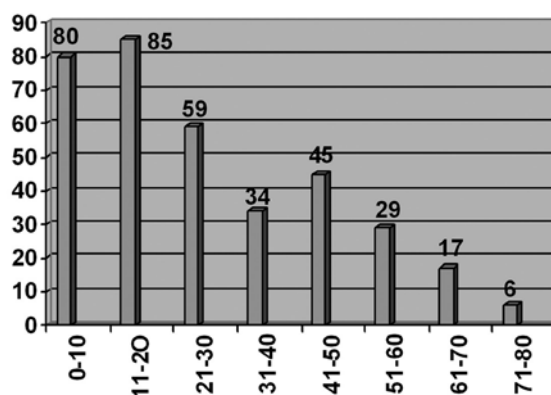


Figure 1. Dog bite injuries distribution related to the age group

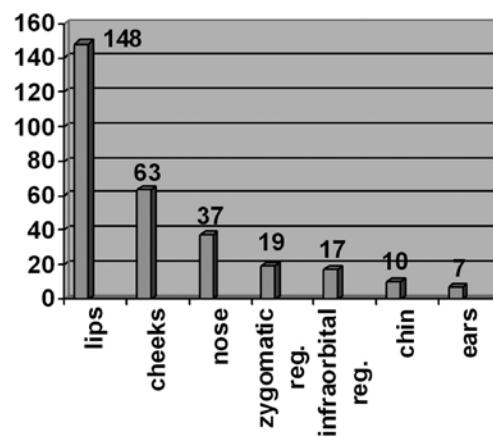


Figure 2. Localization of dog bite injuries in different facial regions

Analysis of the tissue surface and depth according to Lackmann's classification has revealed that most of the injuries were deep and have affected muscles (class II) in 199 patients (53.1%). Superficial injuries (class I) were found in 131 patients (34.9%). In 45 (12%) cases, deep wounds combined with muscles injuries and tissue loss were present (class III). There were no injuries of the IVa and IVb class.

Only five patients in the observed sample were hospitalized (13.3%) for extensive soft tissues injuries. Majority of patients, 370 (86.7%) were treated as outpatients. Average time interval from injury to the hospital admission was six hours.

There were no complications reported following completed surgical treatment. No cases of tetanus or rabies were reported.

Generally, large scars, which usually impair significantly both function and appearance were absent. Consequently, there was not a need for secondary reconstruction.

PATIENT 1 (Figure 3 A, B, C). A 53 year old female was admitted in the hospital two hours after being attacked by a neighbor's dog. Lower lip was injured with a partial avulsion of the vermillion. Reconstruction was completed by use of the local flaps. Postoperative



Figure 3A. Dog bite injury of the lower lip



Figure 3B. Immediately after surgical treatment



Figure 3C. Six months after treatment

course was uneventful with satisfactory long term functional and esthetic results.

3.2. Human bite injuries

Within the observed twenty years period a total of 29 patient bites were inflicted by human teeth. Bites were present more often in men – 25 (86.2%) than in women – 4 (13.8%). Most frequently, bite injuries have occurred in the 21-30 years old group. (Figure 4). In 17 cases (58.6%) bite injuries resulted from physical conflicts, while in twelve cases (41.4%) they were accidentally inflicted following a fall or during sport activities.

Only soft tissues were involved following human bite injuries.

Analyzing the localization of separate bite injuries during fighting, it was found that cheeks were most commonly affected (8 cases – 50%). (Figure 5).

Bite injuries resulted from accidental events in 12 patients, i.e. they have been self-inflicted.

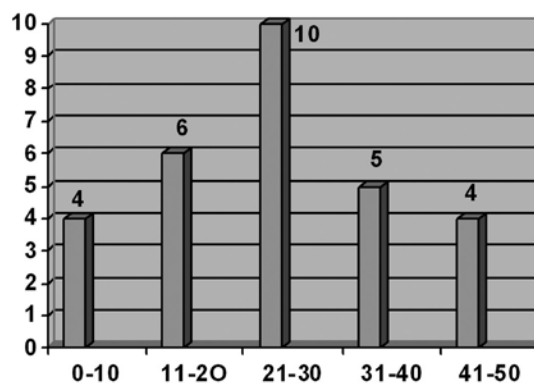


Figure 4. Distribution of human bite injuries according age

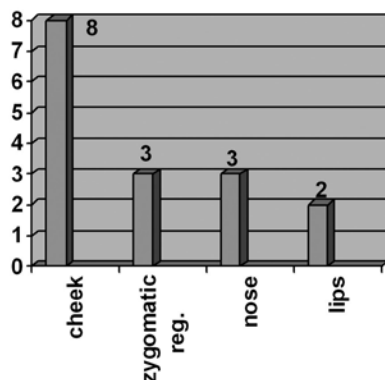


Figure 5. Localization of human bite injuries that occurred during physical conflict

According to the Lackmann's classification, the majority of human bite injuries of the face were of class I – in 17 (58.6%) patients, followed by injuries of II class in 10 (34.48%) patients. Only in two (6.9%) cases, bite injuries were of III class. There were no injuries of the IVa and IVb class.

All patients that have suffered human bite injuries were treated as outpatients. Average time between the injury and admission into the hospital for patients with human bite injuries was four hours. No cases of subsequent infection or other complication in the post operative course were reported.

3.3. Treatment

All patients with animal and human bites in our sample were treated according to the same surgical protocol. For outpatients, the procedure was undertaken under local anesthesia.

The procedure consisted of wound cleansing with 3% hydrogen peroxide and saline, minimal debridement and primary suturing or local flaps with passive drainage when indicated. Antibiotic prophylaxis lasting 5-7 days was obligatory. Amoxicillin was administered in combination of Methronidasole, or clavulanic acid *per os* for Lackmann I and II injuries. Penicillin G, i.m. in combination of Methronidasole *per os*, was given for Lackmann III injuries. Doses were related to the patient's age. In patients with allergies to Penicillin, Clindamycin or Erythromycin was administered as an alternative.

Patients that required hospitalization were treated in general endotracheal anesthesia with the same protocol.

Tetanus and rabies immunization history was necessarily obtained and immune globulin or vaccine was

given if needed [12] according to the tetanus and rabies immunization protocols.

4. Discussion

4.1. Animal bite injuries

The most common bite injuries in humans are inflicted by the dogs, while other animals are involved in lower numbers [1–4,13,14]. It is understandable since canine population is widely spread. It has been estimated that more than one half of households has at least one dog, with France counting approximately nine millions dogs [5,15]. Humans are eager to buy and nurture dogs as pets, for personal protection or for hunting, but sometimes it does happen that they become victims of a canine attack [7,8,16]. Results that were obtained in this study confirm this statement since the majority of all bite injuries which occurred in the region of Belgrade has originated from dogs and less from other domesticated animals. There were more male victims of dog attacks. It may be suggested that men are generally more interested in having a dog or that men develop rough relationship with dogs. Whatever the case is, it results in an increased risk for men to be attacked and injured by dogs [6,13,17]. Results of the present study are revealing that children and young individuals were more frequently bitten by dogs than older individuals, and there are several reasons that explain these findings. For their small body size, children are exposed to a dog's attack predominantly in head and neck area. During their play, young children tend to lean their faces towards the dog's head, thus increasing the risk of injuring maxillo-facial structures. They are not able to anticipate how dogs might be provoked into an aggressive response. As not being well articulated yet, young children often enjoy playing rough with dogs, pulling them by tail or interfering while dogs are eating, which are typical situations when dogs react instantly. Once the dog reacts aggressively, children have no adequate defense. That is why young children should never be left alone with a dog regardless of how friendly it behaves [3,15]. When analyzing causes of the bite injuries in the present sample, in majority of situations, a dog's attack was due to a reaction to inappropriate human behavior. Either, the individual was rough in playing with the dog, or was physically molesting the animal, or interrupting it in meal taking. There are very few cases in which it was reported that dogs attacked with no previous faults in man's behavior [2,3,13].

Soft tissues of the face have been affected by dog bite injuries in all analyzed cases.

Types of injuries were lacerations, avulsions, scratches, abrasions and punctures. Bone structures remained intact in all cases analyzed. The injuries were of the I, II and III class according to Lackmann's classification, which coincides with the results reported by Kesting *et al.* [1]. Joined injuries of soft tissues and bones are usually inflicted by a big dogs' bites. In those cases, their jaws transfer enormous pressure on the tissue grasped [8,9].

Dogs' bite injuries were localized in 80.7% patients in a single area of the face, while two or more areas were involved in 19.7%. These figures correspond to findings published by Baranyiova *et al.* [17]. As for the isolated soft tissue injuries, without bites impact on bones, we can assume that the injured person or some other person may have prevented the dog to continue its attack and provoke more severe facial injuries.

Localization of the bite injuries was most commonly on lips (49.2%), cheeks (20.9%) and nose (12.3%), respectively. While studying bite injuries of the face, Kesting found that most frequently affected are lips, cheeks and nose, and the rarest injuries are on ears [1]. Similar results were reported by Stefanopoulos and co-workers [14]. They found that the mid-region of the face is frequently involved in dog bite injuries. It can be explained by the prominence of mentioned facial structures; lips, cheeks and nose are frontally positioned, thus being first to be touched by canine teeth.

Five patients (13.3%) were hospitalized for extensive injuries of the facial soft tissues while 370 patients (86.7%) were treated as outpatients.

Treatment of all patients was completed according to the same surgical protocol which corresponds to the literature data [10,11,13,18].

Average interval from injury to the admission in hospital was six hours which allowed timely treatment of patients with consequently no complications, nor need for secondary reconstruction. In relation to frequency and consequences of the dog bite injuries, implementation of specific preventive measures becomes mandatory. Having in mind that most victims of dog attacks are young children and youth, the parents are responsible for teaching the children adequate behavior methods toward dogs. In that way, it should be possible to decrease the risk of the dog's aggressive response and consequent attack. Parents, also, should avoid by all means leaving their child alone with the dog, no matter how friendly their relationship with the dog is. Dog owners are ultimately responsible for the dog's discipline and behavior. That is the reason why people who own dogs must be well informed to recognize and prevent any aggressive signs in their pet's behavior.

4.2. Human bite injuries

Literature data suggest that human bite injuries in the maxillo-facial region are present in a significant extent [10,19]. Stierman and coworkers [10] reported that, out of all human bite injuries, 15-20% is localized in head and neck area.

Further research of the bite injuries reveals that the prevalence of human bites is by far less than dog bites, which generally corresponds with results of the present study. Majority of injured patients were men – 25 patients (86.2%) compared to four women (13.4%). These results are consistent with the study by Harrison and co-workers [19] which report that gender ratio in injured patients was 3:1 in men's favor. This is probably due to higher physical activity of men, both in practicing sports and developing aggressive behavior, which further increases the risk of bite injuries, either self-inflicted or by other individual.

Distribution of the bite injuries is variable in different age groups. Most frequently, these injuries were diagnosed in the young population (21 to 30 years old). It can be contemplated that young individuals are socially more active, which may induce conflict situations that result in fighting, when teeth become tools of an attack or defense.

Most of the human bite injuries occur during physical conflict, but a significant amount of these injuries is reported following sexual involvement [20]. Within the sample observed here, human bite injuries by other person's teeth were the results of physical conflicts in total of 17 patients (58.6%). There are no reports on human bites in the maxillofacial region during sexual involvement. In twelve cases (41.4%), bites were self-inflicted by accident, following falls, sports or children's play.

Only facial soft tissues have been involved following human bite injuries. Human teeth might cause various types of the soft tissues injuries, like lacerations, abrasions and avulsion, which may be accompanied by tissue loss. In one case, lower lip was avulsed following physical conflict.

Bite injuries that have happened during fights, were localized only in extra oral tissues, predominantly in a solitary facial region – in 16 patients (94.1%). In only one case (5.9%), bite injuries were diagnosed in two maxillofacial regions – in the upper lip and nose.

During physical conflicts, the most common injury sites were cheeks in eight patients (50%). Injuries in the zygomatic region (three cases) and nose (three cases, 37.5%) were less frequent. Bites of the upper lip and lower lips occurred in one case each (12.5%).

In twelve patients bite injuries have resulted from accidents and were self-inflicted during doing sports or in

children's play. Majority of these injuries were localized on tongue in nine patients (75%), while in three patients (25%) bite injuries involved mucosa and vermillion of the lower lip. This could be explained by the following mechanism of injury: during a fall, the mouth is opened before the impact, leading to the lower jaw being forcibly pressed against the upper jaw so that the bite results in the powerful teeth contact.

Human bite injuries were of the I, II and III class according to Lackmann's classification, which means that soft tissues of the face have been affected. This can be explained by the fact that human bite does not generate high pressure which would lead to bone, vessels or nerves injuries.

All patients with human bite injuries were treated as outpatients by the same surgical protocol used for animal bite injuries management.

The average time from injury to the admission in surgical clinic was four hours, which was shorter than in patients who had suffered animal bites. There were no reported infections or other complication as well, which could be explained with a primary treatment within first six hours after injury, adequate surgical protocol and antibiotic prophylaxis. In other published sources, delayed treatment of infected human bite wounds was also described [21,22].

4.3. Treatment

Despite the different approaches to treatment of human and dog bites [21], good results which were mainly recorded in our study can be related to the following facts. In all cases, the procedure was initiated by cleansing the wounds with peroxide and saline, thus foreign bodies and blood clots were removed and counts of potentially pathogenic microorganisms decreased. It lowered the infection risk rate at later stages [11,13,14].

Further surgical debridement of devitalized tissues was performed in the form of minimal tissue removal with the aim of tissue preservation, so that complicated surgical reconstructions were avoided [13]. After the wounds had been cleansed and debrided, the surgical procedure was attempted and was related to the injury extensiveness.

Kesting [1] reported that more than half of the patients suffered superficial injuries which were treated by primary closure following standard wound cleansing.

Conclusively, if the tissue loss was limited and inflammation absent, a primary surgical reconstruction with a small local flap can be completed, regardless of the bite origin. This is coherent with the recommendations of a number of authors [10,11].

When considering the optimal timing for wound closure, different approaches were advocated. Some authors suggested that human bites should not be closed in the primary act, whereas others believe that the surgical procedure is dependent upon infection, time interval from the moment of injury and the extent of the injury. In accordance to that, they recommended that recent, uninfected bite injuries should be sutured primarily while in existing infection cases, the closure has to be delayed [21]. Stierman et al. [10] suggested that human bite injuries that were not treated within the first 24 hours should be closed primarily in order to decrease infection risk.

According to the results in our study, bite injuries have been sutured primarily because all patients were admitted into the hospital within six hours of injury. There were no patients with infection signs on admission. However, some authors recommend a delay in wound closure if there were no infections recorded in patients who have been admitted in the first 24 hours following the bite injuries [11,20].

5. Conclusion

Dog bites are more frequent than human bite injuries. Young males and children are predominately involved. Soft tissues of the face were exclusively affected, with the lips and cheeks being mainly involved. According to Lackmann's classification, the majority of injuries were Class I and II. No complications were noticed, without need for secondary reconstructions.

Factors with the most significant impact on a good clinical outcome after bite injury treatment are the following: stage of the injury (mostly Lackmann class I and II); short time interval from the injury to the admission into the hospital (up to six hours); no infection signs on admission; adequate surgical protocol with antibiotic prophylaxis.

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Conflict of interest statement

Authors state no conflict of interest.

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