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1 **Original Article**

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4 **Human behavior preceding dog bites to the face**

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Highlights

- We examined human and dog interactions preceding bites to the face.
- Bending over a dog, putting the face to the dog's face and gazing between victim and dog preceded bites.
- More than half of the bites were directed towards the central area of the face.
- People should be warned to not express behavior that might be followed by a dog bite to the face.

Abstract

Facial injuries caused by dog bites pose a serious problem. The aim of this study was to determine human behavior immediately preceding a dog bite to the face and to assess the effects of victim age and gender and dog sex and size on the location of the bite to the face and the need for medical treatment. Complete data on 132 incidents of bites to the face were analysed.

A human bending over a dog, putting the face close to the dog's face, and gazing closely between victim and dog preceded a dog bite to the face in 76%, 19% and 5% of the cases, respectively. More than half of the bites were directed towards the central area of the victim's face (nose, lips). More than two thirds of the victims were children, none of the victims was an adult dog owner and only adult dogs bit the face. Victim age and gender and dog sex and size did not affect the location of the bite on the face. People who were bitten by large dogs sought medical treatment more often than people who were bitten by small dogs (P

< 0.01). Risk factors such as bending over the dog, putting the face close to the dog's face and gazing closely between human and dog should be avoided, and children should be carefully and constantly supervised when interacting with dogs.

Keywords: Behavior; Dog; Bites to the face; Facial injury; Human

Introduction

The mutually beneficial relationship between humans and dogs is sometimes overshadowed by bites. Possible injuries range from minor lacerations to fatal wounds (Horswell and Chahine, 2011). Epidemiological studies indicate that the most common victims of dog bite injuries are children (Wright, 1991; Overall and Love, 2001; Ozanne-Smith et al., 2001) and most dogs that bite are familiar with their victims (Gershman et al., 1994; Brogan et al., 1995; Bernardo et al., 2002; Kaye et al., 2009). Among the more serious dog bite injuries are those that occur on the face (Tu et al., 2002). The most serious cases can have cosmetic and functional consequences (Mcheik et al., 2000). The incidence of bites to the face is associated with victim age; children are mostly bitten on the face, whereas adults are usually bitten on the limbs (Morgan and Palmer, 2007).

In order to develop an effective preventative program, it is necessary to recognise which interactions between humans and dogs are likely to result in a bite injury (Mathews and Lattal, 1994; Mills and De Keuster, 2009). Although literature on dog bites to humans is extensive, little or no research has been conducted on the behavior of both human and dog during most incidents (Love and Overall, 2001; Reisner et al., 2007). Similarly, we are poorly equipped to draw any conclusions about what triggers bites to the face (De Keuster and Overall, 2011). The objective of the present study was to determine human behavior immediately preceding a dog bite to the face when other parts of the body were not bitten and to identify the location of the bite on the face. The effect of victim age and gender and dog sex and size on the location of the bite on the face and whether medical treatment was sought were assessed simultaneously.

Materials and methods

Data collection

Participants were recruited via fliers that were posted in local veterinary practices and dog shows in Moravia (Czech Republic). All cases where dogs only bit the face but not other parts of the body were included in the study. Data on dog bites to the face were collected from January 2012 to June 2014 from dog owners, children's parents, and victims who voluntarily contacted our department seeking an explanation for this undesirable behavior. At the time of the dog bite consultation, all participants were asked to complete a questionnaire that was divided into two sections: (1) victim and dog characteristics, and (2) victim and dog behavior. The questionnaire was pre-tested with 12 subjects not included in this study, and after a few minor modifications, was explained to the participants. At the time of the consultation, every participant had completed the questionnaire. An experienced interviewer assessed the completed questionnaire. Direct enquiries were made to the participants when data was missing. Fourteen questionnaires were excluded because of incomplete data.

Victim and dog characteristics

For each incident of a bite to the face, gender of victim (male, female), age of victim (child, < 18 years; adult, \geq 18 years), breed of dog (specific breed, crossbreed), age of dog, sex of dog (male, female), size of dog (small, medium, large), familiarity between victim and dog, location of the incident, presence of the child's parent and dog owner, location of the bite on the face (nose, upper lip, lower lip, chin, cheek, forehead, eye area), whether medical treatment was sought and whether only the soft tissue of the face was injured were recorded. Four male dogs and one female dog were neutered.

Dogs were classified as pure breeds based on the Fédération Cynologique Internationale (FCI) breed standards categories. Pure breeds were identified based on a photo

that was shown by the interviewer to the victim/owner, who chose the breed. The remaining dogs were classified as crossbreeds. Dogs were classified as small (<30 cm), medium (30–50 cm) and large (>50 cm) based on height at the withers as specified in the FCI breed standards. In breeds for which the height at the withers was not specified in the FCI breed standards and in crossbreeds, the size was classified subjectively based on the description of the dog. Adult dogs were >9 months of age in small breeds, >12 months of age in medium breeds, and >16 months of age in large breeds (Pineda and Dooley, 2003).

Bites were divided by familiarity of the victim with the dog into three groups: (1) familiar people who lived permanently with the dog for at least the preceding month (owners and other members of the household where the dog lived); (2) familiar people who did not live permanently with the dog, but came into contact with the dog at least once weekly for at least the preceding month, and (3) other people who were classified as unfamiliar. Bites were categorised by location into two groups: (1) in the dog's home, yard, garden and surrounding area, or (2) outside those places. The location of the bite on the face was classified into two groups: (1) on the central area on the face (nose, upper lip, lower lip), or (2) external area on the face (chin, cheek, forehead, eye area). Victims were also categorised into two groups based on whether they sought medical treatment or not.

Victim and dog behavior

The part of the questionnaire that covered the behavior of victims immediately preceding the bite was developed from 2007-2011 based on discussions with dog owners who witnessed a dog bite to the face. Preliminary analysis suggested that a human bending over a dog, putting the face close to the dog's face, or gazing between dog and human, might trigger a dog bite to the face. In addition, some behaviors reported in published studies of dog bites

(Reisner et al., 2007; Cornelissen and Hopster, 2010) were included in the questionnaire. This list of additional circumstances in which dogs might bite was from a clinical canine patient population where dogs were presented for an aggression complaint. For each incident, one of the types of the last behavior displayed by a victim immediately before a dog bite to the face was indicated, i.e. bending over a dog, putting the face close to the dog's face, gazing between dog and victim, stepping on a dog, pulling the dog's hair or body, falling on a dog, punishment by hitting, scolding a dog, or trimming the dog's nails.

Displaying one of the following signs (growling, curling of lips, baring the canine teeth or snarling) was classified as a threat (Rezac et al., 2011). For each incident, participants were asked to indicate whether the dog showed a threat immediately before the bite to the face.

Statistical analysis

Statistical evaluation of the data was performed using the SAS software (SAS Institute). Complete data on 132 incidents of bites to the face were used for analysis. Frequencies of occurrence of particular characteristics and behavior were expressed as percentages. The effect of the victim age and gender and dog sex and size on the location of the bite on the face and whether medical treatment was sought was analysed using the chi-square test. Results were considered to be statistically significant at $P < 0.05$.

Results

A human bending over a dog, putting the face close to the dog's face and gazing between human and dog immediately preceded a dog bite to the face in 76%, 19% and 5% of all cases ($n = 132$), respectively (Table 1). Victims did not step on the dog, pull the dog's hair

or body, fall on the dog, punish the dog, scold the dog or trim the dog's nails immediately before any of the incidents of bites to the face. The proportion of male and female victims was 40% and 60%, respectively. The mean age (\pm standard error, SE) of the victims was 15.4 ± 1.2 years. Children and adults were bitten in 70% and 30% of the cases, respectively. Eighty-four percent of all bitten children were <12 years old. The children were bitten on the face in the presence of their parent in 43% of cases and in the presence of the dog owner in 62% of cases. Familiar people who did not live permanently with the dog were bitten in 40% of the cases. Household members were bitten by their dog in 39% of cases. None of the victims was an adult dog owner.

Male and female dogs caused 68% ($n = 90$) and 32% ($n = 42$) of the bites to the face, respectively. In all cases, only adult dogs bit the face. The mean age (\pm SE) of dogs was 5.9 ± 0.2 years. Small, medium and large dogs bit the face in 33%, 19% and 48% of the cases, respectively. Dachshunds and German shepherds bit the face in 15% and 11% of the cases in this study, respectively. These two breeds are also two of the most common in Moravia (Czech Republic). No other breeds were responsible for $>4\%$ of the bites to the face. Dogs that bit were on or off a leash in 5% and 95% of the cases, respectively. Bites to the face occurred in the home, yard and garden where dogs lived in 80% of the cases. People reported that dogs displayed one of the threats listed prior to the bite to the face in 6% of the cases.

Victims were bitten on the central area of the face (nose, lips) and external area of the face (chin, cheek, forehead, eye area) in 53% and 47% of the cases, respectively. Victim age and gender and dog sex and size did not affect the occurrence of central and external bites on the face (Table 2). People who were bitten had soft tissue injuries to the face.

Victims sought medical treatment in 49% of all cases. People who were medically treated had a puncture wound, laceration and tissue avulsion in 17%, 60% and 23% of cases, respectively. People who were not medically treated had a bruise, puncture wound and laceration in 30%, 33% and 21% of cases, respectively; the remaining 16% of people who were not medically treated were uninjured. The size of the dog was associated with whether the victim sought medical treatment (Table 3); people who were bitten by large dogs sought medical treatment more often than people who were bitten by small dogs ($P < 0.01$). The victim age and gender and dog sex did not affect whether the victim sought medical treatment.

Discussion

This study has shown that a human bending over a dog, putting the face close to the dog's face, or gazing between human and dog, closely preceded a dog bite to the face. Immediately before being bitten on the face, victims did not step on the dog, tug the dog's hair or body, fall on the dog, punish the dog by hitting, scold the dog or trim the dog's nails. A number of studies (Mathews and Lattal, 1994; Gandhi et al., 1999; Kahn et al., 2003; Schalamon et al., 2006; Daniels et al., 2009; Nahlik et al., 2010; Reisner et al., 2011) have described human behavior before a dog bite to the body. Some studies also report bending over a dog (Rettinger and Reichensperger-Goertzen, 1995; Reisner et al., 2007) and gazing between human and dog (Borchelt, 1983; Cameron, 1997) as possible causes of bites to the human body. However, it is difficult to compare the findings of our study with previous studies because previous work did not determine human behavior immediately preceding a dog bite to the face when other parts of the body were not bitten.

More than three quarters of all bites to the face were preceded by the victim bending over the dog. Another type of behavior that preceded a bite to the face was gazing between human and dog. More than half of all dog bites were directed towards the central area of the victim's face (nose and lips), confirming the findings of other studies that reported that the central region of the face was injured most often (Kizer 1979; Palmer and Rees, 1983; Karlson, 1984; Rettinger and Reichensperger-Goertzen, 1995; Javaid et al., 1998; Mcheik et al., 2000; Monroy et al., 2009; Horswell and Chahine, 2011). Victim age and gender and dog sex and size had no influence on the location of the bite on the victim's face. This supports the finding that dogs directed the bite to the central area of the face.

It could be speculated that a dog bites to the face were associated with fear-induced aggression. This is based on the assumptions that fearful dogs might bite people (Guy et al., 2001; Reisner et al., 2007), and that petting usually involves bending over the dog and could induce fear (Kuhne et al., 2012). However, one published analysis of canine behavioral responses and physiological characteristics resulting from physical human–dog interactions revealed significant differences depending on human–dog familiarity. Stress (measured as increased plasma cortisol concentration) was induced after dogs were exposed to a novel environment (Tuber et al., 1996). Another study reported that signs of behavioral and physiological (increased heart rate) stress were identified when dogs in a novel environment were stroked by a person who did not live permanently with them (Kuhne et al., 2014). However, other studies have shown that signs of stress were not present when dogs in novel environments were with people who lived permanently with them. Odendaal and Meintjes (2003) reported that blood pressure significantly decreased and concentrations of β -endorphin, oxytocin, prolactin, β -phenylethylamine, and dopamine increased when dogs in a novel environment were stroked by people who lived permanently with them. Another study

of dogs undergoing clinical examinations found that their heart rates were significantly lower when they were in the presence of people who lived permanently with them (Palestrini et al., 2005). Similarly, cortisol levels did not increase if dogs were exposed to a novel environment in the presence of people who lived permanently with them (Tuber et al., 1996).

More than two thirds of the victims in our study were children and most of them were younger than 12 years of age. A similar ratio of children was reported in other studies (Overall and Love, 2001; Ozanne-Smith et al., 2001; Stefanopoulos and Tarantzopoulou, 2005; Morgan and Palmer, 2007). Moreover, in all cases victims were bitten on the face only by adult dogs. These findings suggest that both victim- and dog age could play important roles in the risk for bites to the face. Our results showed that none of the victims of bites to the face were adult dog owners. We do not know why this difference exists and further research is necessary to understand this finding.

The bite incidents in our study took place mostly in the dog owner's home, yard or garden. Additionally, more than three quarters of the bites to the face were directed towards familiar people. Knowing the dog and being indoors when bitten are closely related to being bitten on the face (Reisner et al., 2011). Moreover, people are probably more likely to pet dogs in the dog's home, yard or garden. Therefore, while indoor location and familiarity with the dog play important roles in the potential risk for a facial bite, they are not necessary conditions.

In nearly half of the incidents, children were bitten on the face in the presence of their parent. A similar statistic was also observed when the dog owner was present. Thus, the mere presence of an adult is not an effective barrier to prevent a dog from biting a child's face. The

proximity of an adult does not necessarily imply adequate supervision, because caregivers can be unaware of bite risks, or they might underestimate the risk of bites and be less vigilant when the child is being quiet or affectionate with the dog (Mathews and Lattal, 1994; Reisner et al., 2011). Even bite prevention programs that have been shown to teach children to discriminate between risky and non-risky behavior (Meints and De Keuster, 2009; Schwebel et al., 2012) did not, when used alone in 3 h of training over 3 weeks, prevent risky and species inappropriate behaviors in an experimental setting using unfamiliar Delta Society-certified dogs (Schwebel et al., 2012). Furthermore, evaluation of parental behavior after exposure to The Blue Dog, a dog bite prevention and education program, revealed an ongoing lack of parental appreciation of which interactions between dogs and children constituted risky behavior (Morrongiello et al., 2013), possibly because parents assumed that their children would not be injured in the study. These studies, in combination with the data presented here, indicate that risk mitigation in children requires ongoing age-appropriate education and schooled practice, and that parental involvement is key and still largely lacking. Accurate education about risk assessment and appropriate human and dog behaviors is needed as part of any effective anticipatory guidance from both pediatricians and veterinarians, yet such comprehensive education is still lacking.

Male dogs inflicted facial bites twice as often as female dogs. The prevalence of bites by male dogs in our study is similar to other studies (Gershman et al., 1994; Reisner et al., 2007; Rosado et al., 2009). This indicates that the sex of the dog could have an effect on the occurrence of bites to the face. Large dogs bit the face more frequently than small and medium dogs, perhaps because the head of a large dog is often closer to the human face. By contrast, small dogs bit the face more frequently than medium dogs. One of the possible explanations might be that people usually bent over smaller dogs to pet them.

Victims in our study sustained only soft tissue facial wounds. This type of injury was described in a number of studies (Palmer and Rees, 1983; Karlson, 1984; Javaid et al., 1998; Monroy et al., 2009). Additionally, in more than half of cases medical treatment was not sought, but this was less likely to be the case in people bitten by large dogs than in those bitten by small dogs. It is known that the bite force of larger dogs is greater than that of smaller dogs (Ellis et al., 2009). The requirement for medical treatment was not affected by dog sex or victim age and gender.

We recognize the limitations of our study focused on dog bites to the face. Data were collected retrospectively from dog owners, parents or victims. We acknowledge the inherent limitations of retrospective data collection, which relies on recollections of victim and dog behavior and other relevant circumstances. There are many aspects of the interactions and circumstances relevant to the bite incidents for which data was not collected. Therefore, conclusive statements cannot be made about anything other than victim demographics and the human behaviors preceding the bites. The exact motivation for a dog to bite is purely speculative without a detailed history and accurate review of body language associated with the event.

Conclusions

Bending over a dog, putting the face close to the dog's face and gazing between dog and victim immediately preceded a bite to the face. However, stepping on the dog, tugging the dog's hair or body, falling on the dog, punishing the dog by hitting, scolding the dog and trimming the dog's nails did not result in bites to the face when only the face was bitten. Therefore, to decrease the risk of a bite to the face, people should be warned to not express

behaviors known to immediately precede a dog bite to the face. Moreover, children should be carefully and constantly supervised and avoid known risk factors.

Conflict of interest statement

IGA MENDELU played no role in the study design or in the collection, analysis and interpretation of data, or in the decision to submit the manuscript for publication. None of the authors has any other financial or personal relationships that could inappropriately influence or bias the content of the paper.

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Table 1

Data collected for 132 dog bites to the face

Data	<i>n</i> (%)
Victim behavior preceding dog bite	
Bending over dog	100 (76)
Putting face close to dog's face	25 (19)
Gazing between human and dog	7 (5)
Victim gender	
Male	53 (40)
Female	79 (60)
Victim age	
Child (< 18 years)	92 (70)
Adult (≥ 18 years)	40 (30)
Presence of parent with child	
Present	40 (43)
Not present	52 (57)
Presence of dog owner with child	
Present	57 (62)
Not present	35 (38)
Familiarity between victim and dog	
Familiar people who lived permanently with the dog	51 (39)
Familiar people who did not live permanently with the dog	53 (40)
Unfamiliar people	28 (21)
Dog sex	
Male	90 (68)
Female	42 (32)
Dog size	
Small	43 (33)
Medium	25 (19)
Large	64 (48)
Location of incident	
Dog owner's home, yard and garden	105 (80)
Public areas	27 (20)
Location of bite on face	
Central area on face (nose, lips)	70 (53)
External area on face (chin, cheek, forehead, eye area)	62 (47)
Sought medical treatment	
Sought treatment	65 (49)
Did not seek treatment	67 (51)

Table 2

The effect of the victim age and gender and dog sex and size on the occurrence of central (nose, lips) and external (chin, cheek, forehead, eye area) bites on the face in 132 bite incidents

Characteristics	Central bite, <i>n</i> (%)	External bite, <i>n</i> (%)	DF	<i>P</i> ^a
Victim gender				
Male	27 (51)	26 (49)	1	0.69
Female	43 (54)	36 (46)		
Victim age				
Child (< 18 years)	46 (50)	46 (50)	1	0.29
Adult (≥ 18 years)	24 (60)	16 (40)		
Dog sex				
Male	49 (54)	41 (46)	1	0.63
Female	21 (50)	21 (50)		
Dog size				
Small	23 (53)	20 (47)	2	0.70
Medium	15 (60)	10 (40)		
Large	32 (50)	32 (50)		

DF, degrees of freedom.

^a Chi-square test

Table 3

The effect of the victim age and gender and dog sex and size on seeking medical treatment of facial injuries in 132 bite incidents as analysed by chi-square test

Characteristics	Treated, <i>n</i> (%)	Untreated, <i>n</i> (%)	DF	<i>P</i> ^a
Victim gender				
Male	26 (49)	27 (51)	1	0.97
Female	39 (49)	40 (51)		
Victim age				
Child (< 18 years)	48 (52)	44 (48)	1	0.31
Adult (≥ 18 years)	17 (43)	23 (57)		
Dog sex				
Male	47 (52)	43 (48)	1	0.32
Female	18 (43)	24 (57)		
Dog size				
Small	15 (35) ^b	28 (65)	2	0.01
Medium	10 (40)	15 (60)		
Large	40 (62) ^b	24 (38)		

DF, degrees of freedom.

^a Chi-square test

^b Values differ significantly ($P < 0.01$)