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Author: P. Rezac, K. Rezac, P. Slama

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1 **Original Article**
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4 **Human behavior preceding dog bites to the face**
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7 P. Rezac *, K. Rezac, P. Slama
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9 *Department of Animal Morphology, Physiology and Genetics, Mendel University, Zemedelska*
10 *1, 61300 Brno, Czech Republic*

11
12
13
14
15 * Corresponding author. Tel.: +420 545133156.
16 *E-mail address: prezac@mendelu.cz* (P. Rezac).
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18

19 **Highlights**

20

21 • We examined human and dog interactions preceding bites to the face.

22 • Bending over a dog, putting the face to the dog's face and gazing between victim and dog

23 preceded bites.

24 • More than half of the bites were directed towards the central area of the face.

25 • People should be warned to not express behavior that might be followed by a dog bite to

26 the face.

27

28

29 **Abstract**

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

35

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

43 < 0.01). Risk factors such as bending over the dog, putting the face close to the dog's face and
44 gazing closely between human and dog should be avoided, and children should be carefully
45 and constantly supervised when interacting with dogs.

46

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

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49 **Introduction**

50 The mutually beneficial relationship between humans and dogs is sometimes
51 overshadowed by bites. Possible injuries range from minor lacerations to fatal wounds
52 (Horswell and Chahine, 2011). Epidemiological studies indicate that the most common
53 victims of dog bite injuries are children (Wright, 1991; Overall and Love, 2001; Ozanne-
54 Smith et al., 2001) and most dogs that bite are familiar with their victims (Gershman et al.,
55 1994; Brogan et al., 1995; Bernardo et al., 2002; Kaye et al., 2009). Among the more serious
56 dog bite injuries are those that occur on the face (Tu et al., 2002). The most serious cases can
57 have cosmetic and functional consequences (McCheik et al., 2000). The incidence of bites to
58 the face is associated with victim age; children are mostly bitten on the face, whereas adults
59 are usually bitten on the limbs (Morgan and Palmer, 2007).

60

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

72

73 **Materials and methods**

74 *Data collection*

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

87

88 *Victim and dog characteristics*

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

96

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

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

106

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

117

118 *Victim and dog behavior*

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

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

131

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

136

137 *Statistical analysis*

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

144

145 **Results**

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

149 or body, fall on the dog, punish the dog, scold the dog or trim the dog's nails immediately
150 before any of the incidents of bites to the face. The proportion of male and female victims was
151 40% and 60%, respectively. The mean age (\pm standard error, SE) of the victims was $15.4 \pm$
152 1.2 years. Children and adults were bitten in 70% and 30% of the cases, respectively. Eighty
153 four percent of all bitten children were <12 years old. The children were bitten on the face in
154 the presence of their parent in 43% of cases and in the presence of the dog owner in 62% of
155 cases. Familiar people who did not live permanently with the dog were bitten in 40% of the
156 cases. Household members were bitten by their dog in 39% of cases. None of the victims was
157 an adult dog owner.

158

159 Male and female dogs caused 68% ($n = 90$) and 32% ($n = 42$) of the bites to the face,
160 respectively. In all cases, only adult dogs bit the face. The mean age (\pm SE) of dogs was $5.9 \pm$
161 0.2 years. Small, medium and large dogs bit the face in 33%, 19% and 48% of the cases,
162 respectively. Dachshunds and German shepherds bit the face in 15% and 11% of the cases in
163 this study, respectively. These two breeds are also two of the most common in Moravia
164 (Czech Republic). No other breeds were responsible for $>4\%$ of the bites to the face. Dogs
165 that bit were on or off a leash in 5% and 95% of the cases, respectively. Bites to the face
166 occurred in the home, yard and garden where dogs lived in 80% of the cases. People reported
167 that dogs displayed one of the threats listed prior to the bite to the face in 6% of the cases.

168

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

173

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

183

184 **Discussion**

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

197

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

207

208 It could be speculated that a dog bites to the face were associated with fear-induced
209 aggression. This is based on the assumptions that fearful dogs might bite people (Guy et al.,
210 2001; Reisner et al., 2007), and that petting usually involves bending over the dog and could
211 induce fear (Kuhne et al., 2012). However, one published analysis of canine behavioral
212 responses and physiological characteristics resulting from physical human–dog interactions
213 revealed significant differences depending on human–dog familiarity. Stress (measured as
214 increased plasma cortisol concentration) was induced after dogs were exposed to a novel
215 environment (Tuber et al., 1996). Another study reported that signs of behavioral and
216 physiological (increased heart rate) stress were identified when dogs in a novel environment
217 were stroked by a person who did not live permanently with them (Kuhne et al., 2014).
218 However, other studies have shown that signs of stress were not present when dogs in novel
219 environments were with people who lived permanently with them. Odendaal and Meintjes
220 (2003) reported that blood pressure significantly decreased and concentrations of β -
221 endorphin, oxytocin, prolactin, β -phenylethylamine, and dopamine increased when dogs in a
222 novel environment were stroked by people who lived permanently with them. Another study

223 of dogs undergoing clinical examinations found that their heart rates were significantly lower
224 when they were in the presence of people who lived permanently with them (Palestrini et al.,
225 2005). Similarly, cortisol levels did not increase if dogs were exposed to a novel environment
226 in the presence of people who lived permanently with them (Tuber et al., 1996).

227

228 More than two thirds of the victims in our study were children and most of them were
229 younger than 12 years of age. A similar ratio of children was reported in other studies
230 (Overall and Love, 2001; Ozanne-Smith et al., 2001; Stefanopoulos and Tarantzopoulou,
231 2005; Morgan and Palmer, 2007). Moreover, in all cases victims were bitten on the face only
232 by adult dogs. These findings suggest that both victim- and dog age could play important
233 roles in the risk for bites to the face. Our results showed that none of the victims of bites to
234 the face were adult dog owners. We do not know why this difference exists and further
235 research is necessary to understand this finding.

236

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

244

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

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

265

266 Male dogs inflicted facial bites twice as often as female dogs. The prevalence of bites
267 by male dogs in our study is similar to other studies (Gershman et al., 1994; Reisner et al.,
268 2007; Rosado et al., 2009). This indicates that the sex of the dog could have an effect on the
269 occurrence of bites to the face. Large dogs bit the face more frequently than small and
270 medium dogs, perhaps because the head of a large dog is often closer to the human face. By
271 contrast, small dogs bit the face more frequently than medium dogs. One of the possible
272 explanations might be that people usually bent over smaller dogs to pet them.

273

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

281

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

291

292 **Conclusions**

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

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

300

301 **Conflict of interest statement**

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

306

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309

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463

464 **Table 1**

465 Data collected for 132 dog bites to the face

Data	n (%)
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)

466

467

468 **Table 2**

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

472

Characteristics	Central bite, n (%)	External bite, n (%)	DF	P ^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)		

473 DF, degrees of freedom.

474 ^aChi-square test

475

476 **Table 3**

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

479

Characteristics	Treated, n (%)	Untreated, n (%)	DF	P ^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)		

480 DF, degrees of freedom.

481 ^aChi-square test482 ^bValues differ significantly ($P < 0.01$)