Published in final edited form as:
Vet Comp Orthop Traumatol. 2014 ; 27(3): 192–197. doi:10.3415/VCOT-13-06-0074.

Retrospective Evaluation of Canine and Feline Maxillomandibular Trauma Cases; A Comparison of Signalment with Non-Maxillomandibular Traumatic Injuries (2003-2012)

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Summary

Objectives—To determine differences in signalment between maxillomandibular (MM) and non maxillomandibular (non-MM) trauma patients to help predict the type of injury sustained.

Methods—A medical records database was searched from December 2003-September 2012 to identify all MM trauma patients, and also a random sample of non-MM trauma patients was generated. Patient species, age, sex, weight, and injury aetiology were recorded for both populations.

Results—Sixty-seven MM trauma patients and 129 non-MM trauma patients were identified. Feline patients were almost twice as likely to be presented for MM trauma compared with non-MM trauma. The median weight of canine patients suffering MM injury was significantly less than that of non-MM patients (p=0.025). A significant association existed between the causes of injuries associated with MM and non-MM trauma populations (p=0.000023). The MM trauma patients were more likely to sustain injury as a result of an animal altercation (Bonferroni p=0.001) while non-MM injuries were more likely to result from motor vehicle accidents (Bonferroni p=0.001). Overall animals <1yr of age with traumatic injuries were overrepresented (65/196) in comparison to entire patient population.

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Clinical Significance—The results of this study may help guide clinicians in the evaluation and screening of trauma patients that are presented as an emergency. Cats, small dogs and animals suffering from animal altercations should all be closely evaluated for maxillomandibular injury.

Keywords

maxillomandibular; trauma; fracture; injury; signalment

Introduction

Dogs and cats suffering traumatic injuries to the regions of the maxilla and mandible (maxillomandibular) are frequently presented with fractures. Previous studies have reported an association between maxillomandibular (MM) injury, patient signalment and the cause of injury (1-3). Although causes of traumatic injuries occasionally remain unknown to pet owners, many result from witnessed events. Traumatic injuries resulting from collision with a motorized vehicle (1, 2, 4), as well as pathological fractures related to neoplasia (5, 6) or severe periodontal disease (6, 7) have been studied. In addition, high-rise falls involving cats are associated with symphyseal separation, maxillofacial injuries and other injuries to the musculoskeletal system (2, 8, 9).

Characteristics such as weight, breed, and sex predispose animals to suffer traumatic injuries resulting in MM fractures. Trends in age and sex have been reported in animals suffering MM traumatic injuries (1-3). Male animals are predisposed to suffer traumatic injuries (2, 3), which is consistent with the trends reported in humans (10). Specific differences between the signalment and aetiology of MM trauma populations and non-maxillomandibular (non-MM) trauma populations have not been evaluated in veterinary medicine.

Materials and Methods

A retrospective evaluation of cases that were presented to the University of Wisconsin-Madison Veterinary Medical Teaching Hospital's Orthopaedic, Emergency or Dentistry and Oral Surgery Services from December 2003-September 2012 was performed.

MM Trauma Patients

Medical record data regarding dogs and cats that were presented to the hospital were identified from the case logs of the Dentistry and Oral Surgery residents and the hospital database from December 2003-September 2012. Information collected from the medical records included signalment (species, sex, age, and weight) and cause of injury. Patients described as having MM trauma were animals diagnosed with trauma to any of the following bones: incisive, nasal, palatine, frontal, zygomatic, zygomatic processes of the temporal bones, maxilla and mandible. Any animals that were presented exclusively with soft tissue injuries of the head would have been included in the MM group. Animals diagnosed with dental injuries (tooth fracture/luxation/avulsion) not sustaining an aforementioned injury were not included due to previously reported findings that dental injuries are under diagnosed (4, 8).

Non-MM Trauma Patients

A search of the medical record database was performed to identify canine and feline patients suffering a non-MM trauma injury between December 2003-September 2012. A traumatic injury was defined as any acute injury resulting from an external source. Patients were identified from the hospital database using specific search words (Table 1). Patients that were presented for MM trauma were excluded from the non-MM trauma population. A random sample population of 150 non-MM patients was created using statistical software[a]. Species, sex, age, weight, and cause of injury were recorded. Records of the 150 patients were evaluated and 21 cases eliminated due to incomplete medical record data or the absence of any diagnosed injury. One hundred twenty-nine cases with complete medical records information remained.

MM and non-MM Patients

Patient sex was noted as male or female and reproductive status as castrated, spayed, male (entire) or female (entire). Patient age was recorded in months and weight in kilograms. The inciting injury was classified by cause: trauma resulting from an inanimate object (including falls), unknown trauma, trauma resulting from confrontation with another animal, injury resulting from pre-existing pathology, and trauma associated with a motor vehicle. All injuries were assigned to the appropriate category based on the author's (BLM) review of the medical record.

Data Analysis

Statistical evaluation of the distribution of MM or non-MM patients by species, sex, and reproductive status was calculated using Chi-square test with a statistically significant p-value of < 0.05. A Wilcoxon Rank Sum test was used with a statistically significant p-value of < 0.05 to evaluate the distribution of MM and non-MM patient weight separated by species and the distribution of patient age. Evaluation of the cause of injury between MM and non-MM patients was calculated using a Fisher's exact test. Fisher's exact test with Bonferroni adjusted p-values for the five causes of injuries between the MM and non-MM groups were reported.

Results

Of the patients that incurred MM fractures, 67 patients with complete medical records were identified. Of these patients, 54 canine patients and 13 feline patients were identified. A search of the medical record database using the key search terms yielded 907 non-MM trauma patients. Of these patients, eleven patients were found to have sustained two separate unrelated traumatic injuries on different dates. The random sample population included 115 canine patients and 14 feline patients.

[a]R Core Team (2012). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/

The proportion of cats that were presented for MM trauma (13/67) and non-MM trauma (14/129) were not significantly different (p=0.153). Dogs comprised 54/67 of the MM population and 115/129 of the non-MM population (Table 2).

There was no significant difference between sexes (p=0.975) or reproductively altered status (p=0.376) for animals presenting for MM trauma and non-MM trauma (Table 3).

Dogs and cats were separated when evaluating patient weight (Table 4). The only difference that was significant was between the MM and non-MM (p=0.025) in the canine populations.

Trauma groups demonstrated a statistically significant association (p=0.000023) with cause of injury when comparing patients presented with MM trauma to the non-MM trauma patient population (Figure 1). Fisher's exact tests revealed a significantly higher percentage of animal altercation injuries in the MM group (Bonferroni p=0.001), and a significantly higher percentage of motor vehicle accidents in the non-MM group (Bonferroni p=0.001) (Table 5).

Animal altercations

Traumatic injury resulting from contact with another animal in the MM fracture population included causes such as rough play with housemate, kicked by horse, and attacked by dog, woodchuck or unknown animal. Causes in the non-MM trauma group included kicked by horse, attacked by dog or unknown animal.

Inanimate object

Trauma resulting from an inanimate object in the MM population included: hit by baseball bat, played tug of war, fell from high-rise, caught jaw on splinted leg, fell off chair, kicked in face by owner, “tripped” on landing, “chewed” on wood, caught jaw on chicken wire, ran into trailer hitch, hit jaw when jumped out of stopped car, fell from owners arms, hit with golf club, shot with gun, and fractured mandible when owners tried to “remove” a treat from the oral cavity. Inanimate object trauma in the non-MM population included: fell off of deck, hit by Frisbee, struck by unknown force, caught leg in door, fell from 4 feet, dropped by owner, “slipped” on deck, tangled in cord in front yard, fell from owners arms, stepped on by owner, fell off snow bank, fell off bed, fell off stairs, fallen on by owner, jumped off step, jumped out of owners arms, hit in eye by tennis ball, “injured” while playing in park, caught back leg on deck, jumped while playing, slipped on ice, caught under wheelchair, caught under window, fell from high-rise, fell in hole, ran into “something”, and “elbowed” in the eye.

Motor vehicle trauma

Motor vehicle accidents in the MM fracture population included situations such as: bit moving car tire, hit by: car(s), truck or tractor, and bit tire of skid loader. The non-MM population included causes such as: jumped out of moving truck, and hit by: car, truck, dump truck, plow, or all terrain vehicle.

Pre-existing pathology

Injury resulting from pre-existing pathology in MM fracture patients included instances citing previous jaw fracture at the same location, neoplasia, and periodontal disease-related fracture. Pre-existing pathology was the smallest subset of MM trauma patients. Non-MM trauma patients suffered pathologic fractures associated with neoplasia.

Unknown trauma

Patients were categorized into unknown trauma when the traumatic event was not witnessed. The difference inthe ages of animals suffering MM trauma (28 months [range 1-180]) and non-MM trauma (35 months [range 1-206]) was not significant (p=0.887) (Table 6). When combining the two populations, 33.2% (65/196) of patients were less than 12 months of age (Figure 2).

Discussion

Sex

Male dogs are thought to be more aggressive than female dogs (11, 12). Therefore, it would be expected that they are more likely to incur injuries. This is supported by the influence of sex hormones and genetically determined behavioural patterns such as the need to propagate and demonstrate inter-male aggression (11, 12, 13). Shamir et al. reported that bite wounds occur more frequently in male dogs (14). Male animals are reported to suffer traumatic injuries more frequently overall based on other studies (14, 15). Despite other's findings which suggest an increased incidence for males to be associated with bites, the nearly equal ratio of male to female MM trauma patients in this study is consistent with the study by Kitshoff (16).

Weight

The significant difference between the median weights of dogs that were presented with MM trauma (15.9kg) compared with non-MM trauma (20.8kg) is consistent with other studies reporting that smaller dogs are more predisposed to sustain traumatic MM injuries (14, 16). Although the median weight of the MM population in this study was greater than what has been reported by others, smaller dogs had an increased frequency of MM trauma compared to non-MM trauma.

The region of the mandible commonly associated with mandibular fracture is the premolar and molar region (1, 3, 16). The predilection for small breed dogs to develop periodontal disease with loss of alveolar bone in tooth-bearing areas of the lower jaw may predispose periodontally compromised patients to mandibular fracture (17)

Cause of Injury

Frequently, MM fractures occur due to traumatic incidents (1, 3, 16). Previous studies have reported trauma from motor vehicles as one of the most common causes of traumatic injury to the canine and feline mandible and maxilla (1, 2). One study reported that the prevalence of mandibular injuries resulting from traumatic involvement with motor vehicles was 52.3% (1). The current study found that altercations with other animals (35.8%) were more likely to

result in a MM fracture than trauma associated with motor vehicles (17.9%). Other studies in agreement with the current study report that patients presenting with MM fractures due to altercations with other animals was the most common causes of MM injuries (3, 4, 16). Previous studies also found that MM fractures were more common in felines compared to non-MM fractures (2, 15). Differences with regards to cause of injury may be influenced by a variety of factors. Feral animal populations and local rules governing animal confinement may influence the number of animals that are vulnerable to suffering non-MM injuries from motor vehicles in various locations. In addition, geographic influences such as population density may impact the frequency of animal-animal altercations or motor vehicle accidents. Injury resulting from animal contact with wildlife may occur less frequently while more densely populated locations may demonstrate a higher frequency of trauma resulting from motor vehicles.

For various reasons, smaller dogs may be more prone to sustain a traumatic MM injury (16). Pets in multi-animal households may experience traumatic injuries due to altercations with housemates (19). In mixed species households the smaller animal may simulate a prey species (11), making them susceptible to attack. Excitement, food, toys and territorial disputes may spark conflict or aggressive behaviour between animals in the same household (18). As animals challenge one another head on, they may be predisposed to MM injury rather than sustaining injuries to other areas of the body. Animals suffering trauma from inanimate objects or from unknown trauma are commonly reported in both dogs and cats (1, 3, 16).

When considering the sample population of non-MM traumatic injuries, 46.5% of cases sustained trauma associated with a motor vehicle. Only 11.6% sustained trauma from an altercation with an animal. This finding is consistent with other reports where motor vehicle incidents were reported more frequently as the inciting cause of injury compared to altercations with other animals. (2) It has been speculated that non-MM injury caused by motor vehicles may be due to the instinctive tendency to protect the head from force and expose the chest or abdomen to trauma (19).

Age

It has been shown that young animals have a predilection toward suffering traumatic events (1, 2, 3, 15,16). Another recent study found 57% of animals that are presented for MM fracture management were less than 12 months of age (16). Although differences in age between populations were not significant, animals less than 12 months represented 33.2% (65/196) of the current patient population. A definitive explanation for these repeated findings (1, 2, 3, 15, 16) has not been proven. Speculation that trauma arises from inter-household aggression, dominance (20) and bite injuries caused by animals protecting their territory, being afraid, playing or protecting their property may reasonably explain why these injuries occur (21).

Limitations

The inherent nature of a retrospective design may limit the quality and accuracy of information in the medical records. Only complete medical records were included in this

study. Information within the medical record was completed by several people with varying levels of veterinary medical training and at times may have been inaccurate. Other limitations include inaccuracies concerning the owner's recollection as to the cause of the trauma. Due to a small sample size, statistical significance could have been improved with larger MM and non-MM groups.

Conclusion

MM fractures occur in canine and feline patients due to a variety of insults. Cats appear to be predisposed to sustain MM injuries relative to non-MM injuries and should be closely evaluated for maxillomandibular trauma following a traumatic event. The majority of MM injuries in this study resulted from altercations with other animals. Non-MM injuries resulted more frequently from motor vehicle trauma. A sex predilection does not appear to exist for dogs and cats suffering traumatic injuries. , No significant age predilection was shown between animals suffering from non-MM or MM trauma, however 35% of the combined population of patients were less than 12 months of age. Smaller dogs had increased likelihood to sustain MM injury in comparison to non-MM injury. Smaller dogs suspected of sustaining a traumatic event should be carefully evaluated for MM injury due to increased predilection to sustain this type of injury.

Acknowledgements

The authors would like to thank Sushant Rana and Matthew Stogsdill for help with data collection. The project described was supported by the Clinical and Translational Science Award (CTSA) program, through the NIH National Center for Advancing Translational Sciences (NCATS), grant UL1TR000427. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

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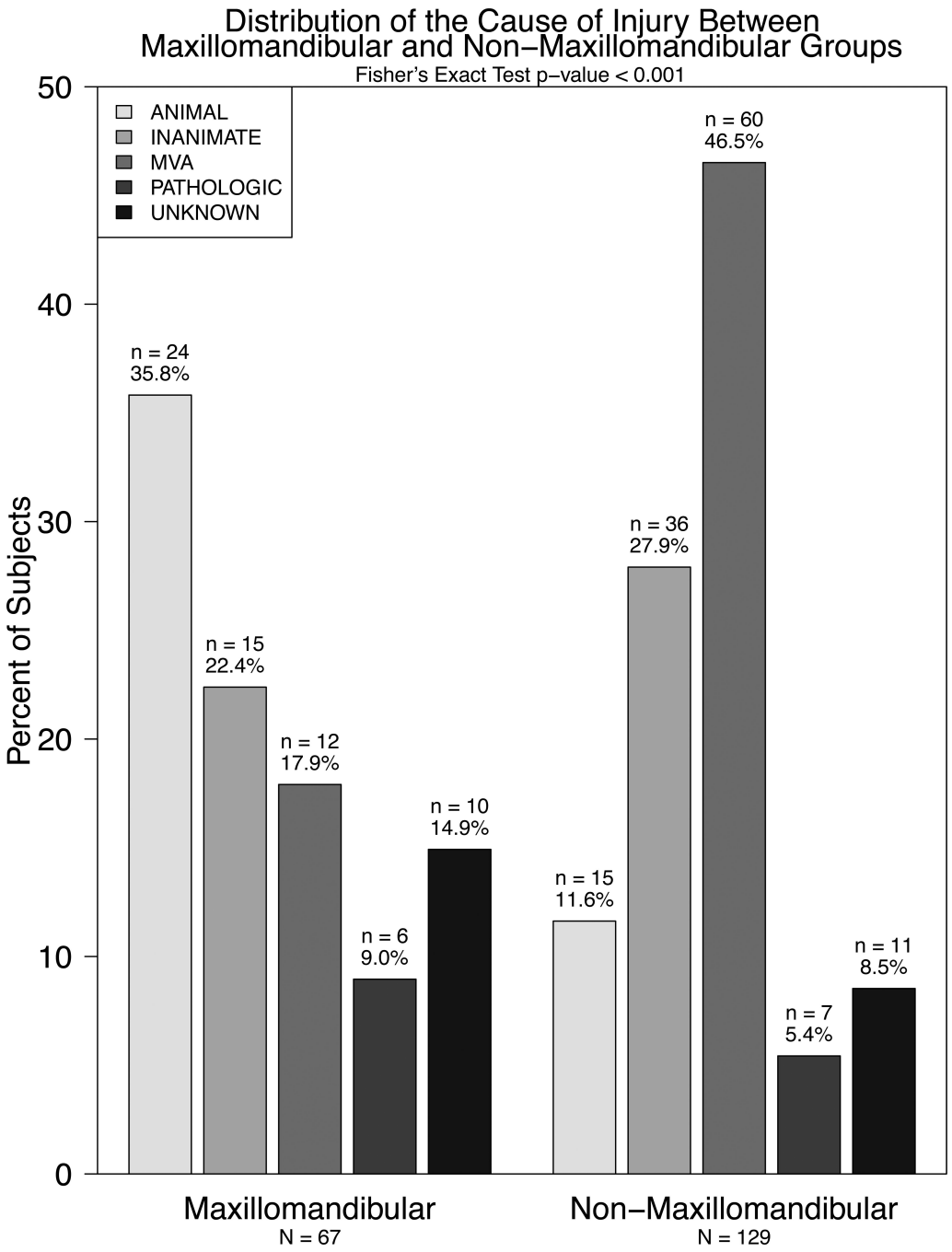

Figure 1.

Cause of injury between maxillomandibular (MM) and non-maxillomandibular (non-MM) trauma populations. Animal = animal altercation, Inanimate = trauma from an inanimate object, MVA= motor vehicle accident, Pathologic= pathologic injury, Unknown= trauma resultant from an unknown cause. P-value = 0.000023 calculated using Fisher's exact test comparing the difference in distribution between the MM and non-MM groups.

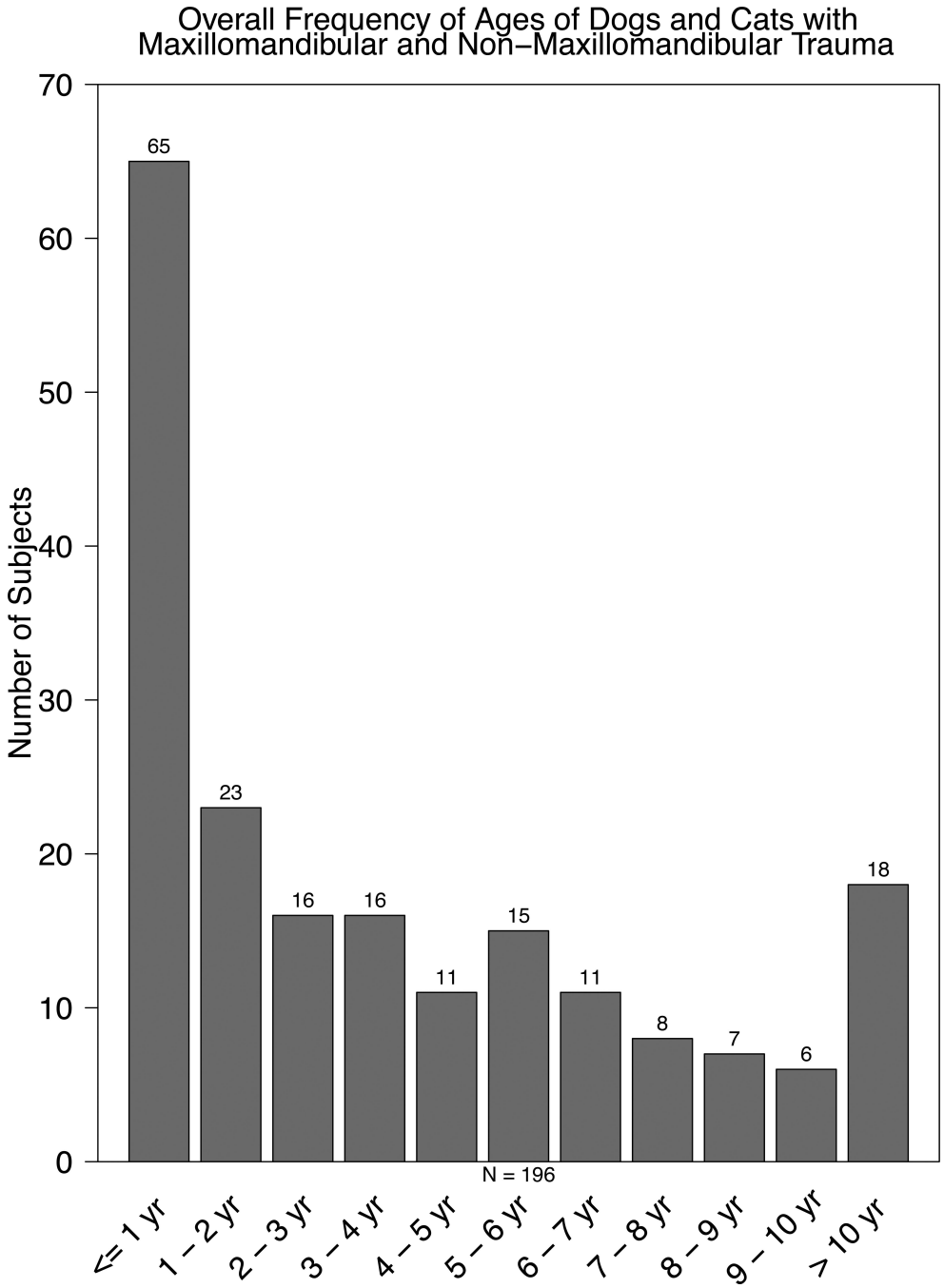

Figure 2.
Frequency of age distribution involving both maxillomandibular (MM) and nonmaxillomandibular (non-MM) trauma populations.

Table 1

Abbreviations and Key Words Searched in the Medical Records Database

HBC (hit by car)	hit
MVA (motor vehicle accident)	injury / injured
bit(e)	motor
blow	run over
broke	struck
car	trauma (truama)
fall / fell	truck
fracture / fx	vehicle / vehicular

Abbreviations, key words and commonly misspelled words queried in the medical record database when searching for trauma patients.

Table 2

Distribution by species for patients presenting with maxillomandibular (MM) or non-maxillomandibular (non-MM) trauma.

Distribution of Species Presenting with Maxillomandibular vs. Non-Maxillomandibular Trauma				
Trauma Location	**Total**	**Canine**	**Feline**	**P-Value**
Maxillomandibular (MM)	67	54 (80.6%)	13 (19.4%)	0.153
Non-maxillomandibular (non-MM)	129	115 (89.1%)	14 (10.9%)	

P-value calculated using Chi-square test comparing the distribution of canines and felines within the MM and non-MM groups.

Table 3

Distribution by sex and reproductive status for patients presenting with maxillomandibular (MM) or non-maxillomandibular (non-MM) trauma.

Comparison of Sex Between the MM and Non-MM Groups				
Trauma Location	**Total**	**Female/Spayed**	**Male/Castrated**	**P-Value**
Maxillomandibular (MM)	67	30(44.8%)	37(55.2%)	0.975
Non-maxillomandibular (non-MM)	129	56(43.4%)	73(56.6%)	

Comparison of Reproductive Status Between the MM and Non-MM Groups						
Trauma Location	**Total**	**Female (intact)**	**Male (intact)**	**Castrated**	**Spayed**	**P-Value**
Maxillomandibular (MM)	67	6 (9.0%)	14(20.9%)	23(34.3%)	24(35.8%)	0.376
Non-maxillomandibular (non-MM)	129	21(16.3%)	24(18.6%)	49(38.0%)	35(27.1%)	

P-values calculated using Chi-square test.

Table 4

Distribution by weight (kilograms) between patients presenting with maxillomandibular (MM) and non-maxillomandibular (non-MM) trauma separated by species.

Animals Suffering MM and Non-MM Trauma Distributed by Species and Compared by Weight the						
	Trauma Location	**Total**	**Median**	**Min**	**Max**	**P-Value**
Canine	Maxillomandibular (MM)	54	10.7	1.1	45.0	0.025
	Non-maxillomandibular (non-MM)	114	19.1	1.4	63.6	
Feline	Maxillomandibular (MM)	13	4.5	1.4	6.5	0.59
	Non-maxillomandibular (non-MM)	13	4.7	1.0	9.4	

P-values calculated using Wilcoxon Rank Sum test. Canines suffering MM injury weighed significantly less than canines suffering non-MM injury.

Table 5

A significantly higher percentage of patients in the MM group were found to present with trauma resulting from animal altercations. Non-MM patients were found to have a significantly higher percentage of patients presenting with injuries resulting from motor vehicle accidents (MVA).

Cause of Injury Comparison Between Animals Suffering MM and Non-MM Trauma

	Maxillomandibular (n=67)	Non-maxillomandibular (n=129)	P-value*
Animal	24 (35.8%)	15 (11.6%)	0.001
Inanimate	15 (22.4%)	36 (27.9%)	1.000
MVA	12 (17.9%)	60 (46.5%)	0.001
Pathologic	6 (9.0%)	7 (5.4%)	1.000
Unknown	10 (14.9%)	11 (8.5%)	1.000

* Bonferroni adjusted Fisher's Exact Test p-values for 5 tests.

Table 6

Distribution by age (months) between patients presenting with maxillomandibular (MM) and non-maxillomandibular (non-MM) trauma.

Distribution by Age of Patients Presenting with MM and Non-MM Trauma					
Trauma Location	**Total**	**Median**	**Min**	**Max**	**P-Value**
Maxillomandibular (MM)	67	28	1	180	0.887
Non-maxillomandibular (non-MM)	129	35	1	206	

P-value calculated using Wilcoxon Rank Sum test.