CLINICAL STUDIES ON THE MANAGEMENT OF DENTAL AND MANDIBULAR AFFECTIONS IN DOGS

Thesis

Submitted to the Guru Angad Dev Veterinary and Animal Sciences University
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MASTER OF VETERINARY SCIENCE
in
VETERINARY SURGERY AND RADIOLOGY
(Minor Subject: Veterinary Anatomy)

By

Jasleen Kaur
(L-2014-V-65-M)

Department of Veterinary Surgery and Radiology
College of Veterinary Science

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CERTIFICATE - I

This is to certify that the thesis entitled "**Clinical studies on the management of dental and mandibular affections in dogs**" submitted for the degree of **M.V.Sc.**, in the subject of **Veterinary Surgery and Radiology** (Minor subject: **Veterinary Anatomy**) of the Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, is a bonafide research work carried out by **Jasleen Kaur (L-2014-V-65-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

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(Dr. Arun Anand)
Major Advisor
Assistant Professor
Department of Veterinary Surgery and Radiology
Guru Angad Dev Veterinary and Animal Sciences University
Ludhiana – 141004 (India)

CERTIFICATE - II

This is to certify that the thesis entitled "**Clinical studies on the management of dental and mandibular affections in dogs**" submitted by **Jasleen Kaur (L-2014-V-65-M)** to the Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, in partial fulfillment of the requirements for the degree of **M.V.Sc.** in the subject of **Veterinary Surgery and Radiology** (Minor subject: **Veterinary Anatomy**) has been approved by the Student's Advisory Committee after an oral examination on the same, in collaboration with an external examiner.

(Dr. Arun Anand)
Major Advisor

(Dr. Adarsh Kumar)
External Examiner
Professor
Dr. G.C. Negi College of Veterinary & Animal Sciences
Deptt. of Vety. Surgery & Radiology, CSKHPKV, Palampur

(Dr. J. Mohindroo)
Head of the Department

(Dr. Simrat Sagar Singh)
Dean, Postgraduate Studies

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ABSTRACT

The present study was conducted in two parts. The first part was a clinical study that consisted of 45 dogs presented with affections of oral cavity and associated structures i.e. teeth and mandible. The cases were divided into 2 groups based on the presenting problem. Out of the 45 dogs presented, 26 cases (Group I) were related to dental tartar, and 19 cases (Group II) were related to mandibular fractures. The fourteen male (53.85%) and twelve female (46.15%) dogs included in group I had an average age of 7.54±0.51 year (1-13 years) and mean body weight 23.11±2.71 kg (3.2-68 kg). A bacteriological culture of swab collected from super gingival dental area of the 26 dogs with dental tartar was done and staphylococcus (42.30%) was found to be most prevalent bacteria with highest in vitro susceptibility to amoxicillin and clindamycin (76.92%). Out of the 26 cases presented with dental tartar, dental scaling along with tooth extraction was performed in 17 (65.38%) cases. Group II included 34 mandible fractures in 19 dogs. Out of the 19 dogs presented, 13(68.42%) had bilateral fractures (26 mandibular fractures), 1 (5.26%) had a bilateral canine fracture as well as a symphyseal fracture and remaining 5 (26.32%) had unilateral fractures. Out of the 19 mandible fracture cases presented, fourteen were males (73.68%) and five were females (26.32%). The mean age was 1.95±0.46 years (ranging from 3 months to 7 years) and mean body weight was 10.94±1.42 kg (ranging from 3.4 to 23.5 kg) with varying clinical signs. Most common site of fracture was canine region (61.76%). Mandible fractures were fixed surgically either by doing orthopaedic wiring or by applying acrylic (Protemp^{TM} 4) as a composite material for the fabrication of temporary restorations. Acrylic provided additional stability to the fractured fragments and formed a hard cast around the wire and fractured site, causing proper immobilization of the site and aiding in better and faster healing of the fracture site. The second part of study was an epidemiological study done on 100 dogs. The dogs above 1 year of age presented for minor conditions like wound management, bandaging, ear infections, small tumours, etc with no pre-existing dental complaints were included in the study.

Keywords: Dental tartar, Tooth extraction, Jaw fractures, Acrylic.

Signature of Major Advisor **Signature of the Student**

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LIST OF ABBREVIATIONS

,	:	Comma
;	:	Semicolon
:	:	Colon
.	:	Fullstop
-	:	Hyphen
’	:	Apostrophe
()	:	Parenthesis
+	:	Plus
±	:	Plus-minus
%	:	Per cent
=	:	Equal
@	:	At the rate of
<	:	Less than
>	:	More than
°F	:	Degree Fahrenheit
b. wt.	:	Body weight
DLC	:	Differential leukocyte count
EDTA	:	Ethylene Diamine Tetra Acetate
et al.	:	and others
etc	:	etcetera
F1	:	Furcation exposure index 1
F2	:	Furcation exposure index 2
F3	:	Furcation exposure index 3
F4	:	Furcation exposure index 4
F	:	Female
Fig.	:	Figure
Hb	:	Haemoglobin
Hrs	:	Hours
i.m.	:	Intramuscular
i.v.	:	Intravenous
Inj.	:	Injection
kg	:	Kilogram
M	:	Male
m	:	Months
mg/kg	:	Milligram per kilogram
min	:	Minute
mL	:	MilliLitre
N	:	Total number of cases
PD	:	Periodontal disease
Post-op	:	Post-operative
Pre-op	:	Pre-operative
Tab.	:	Tablet
TLC	:	Total Leucocyte Count

CHAPTER I

INTRODUCTION

Veterinary dentistry is the science to diagnose and treat the diseases and disorders of the oral cavity, maxillo-facial region, and its associated structures along with their prevention. Veterinary dentistry has been receiving a lot of attention in general practice, but has not yet achieved its potential in referral practice. Similar to human dentists, veterinary dentists treat conditions such as mandibular fractures, malocclusions, oral tumours, periodontal disease and other conditions which are unique to veterinary medicine.

Etiology behind this dental problem is soft diet, absence of bone or meat in diet and lack of dental exercise (Lindhe *et al* 1975). Surgically important dental problems are dental tartar, dental caries (Hale 2009), tooth fracture, tooth extraction (Morrow 2010) and persistent deciduous teeth etc. Due to lack of owner awareness most of the problems remain unnoticed in early course of disease and diagnosed only after halitosis, severe pain or bleeding from mouth and at this stage very less scope remain for repair except the extraction of affected tooth. Therefore precise and scientific examination of oral cavity should be a part of routine physical examination after 3 year of age at least once or twice in a year for early detection of common problem. Considerable delay in early detection of disease process many times leads to dental caries, gingival hyperplasia and tumors.

The affections of oral cavity and associated structures i.e. teeth, mandible and maxilla are of common occurrence in dogs. A large number of such types of cases are routinely presented to the small animal practitioner. Animal affected with these affections have common clinical signs like salivation, anorexia, halitosis, dropping jaw, swelling around face etc. The main affections of the oral cavity and associated structures include oral swellings or masses, dental problems, mandibular and maxillary fractures.

The oral examination is done both on the conscious and anaesthetized patient. The conscious exam is limited to olfactory, visual and tactile examination. A primary indication of oral disease is malodour (Bellows 1999, Livgren *et al* 1995). Only 8% of dental cases are presented by the pet owner specifically for their oral condition. Many

owners think that bad breath is natural in their pet and are not aware that periodontal disease may be the culprit (Livgren *et al* 1995).

Epidemiological studies have shown that periodontal disease and dental calculus are the most common oral diseases in the dog (Page and Schroeder 1981, Hoffmann and Gaengler 1996, Harvey 1998).

Periodontal disease commonly refers to gingivitis, defined as inflammation of the gingival tissues; and periodontitis, which includes gingivitis and the destruction of supporting periodontal tissues. Gingivitis is reversible and can be treated and largely prevented with thorough plaque removal and continued supra-gingival plaque control (Komman 1986, Harvey and Emily 1993a). Periodontitis is more severe and primarily irreversible. It may require advanced therapy and meticulous plaque control to prevent disease progression. Periodontal disease causes local inflammation, eventual tooth loss if not treated, and may be associated with discomfort and pain, particularly with advanced destruction of periodontal tissues (DeBowes 1998).

Dental affections are frequently observed in small animals. Periodontal disease has been identified as the most frequently occurring clinical condition in domestic dogs and cats (Lund *et al* 1999). About 85% dogs older than 5 year of age have some sort of dental affection (Wiggs *et al* 1998) and periodontal disease is most commonly observed (Hennet *et al* 1995) leading to tooth loss in humans (Williams 1990), dogs and cats (Colmery and Frost 1986, Isogai *et al* 1989a). The disease begins with the accumulation of bacterial plaque on the tooth surfaces initiating an inflammatory response that affects the supporting tissues of the tooth and eventuates in loss of attachment (Hennet 1995). Many factors contribute to the prevalence and severity of periodontal disease, including breed, genetics, age, diet, chewing behavior and systemic health (Rugg-Gunn 1993).

Dental plaque is the adherent bacterial mass attached to tooth surfaces and is considered a key factor in the pathogenesis of periodontal disease (Listergarten 1988, Gorrel and Rawlings 1996). Plaque and food particles retain mainly in the area of gingival sulcus, crowded teeth and fractured crown. This leads to calculus deposition and growth of bacteria which cause halitosis, gingivitis, periodontal disease, oral pain, caries and tooth loss. The persistent infection of the oral cavity does not only cause discomfort to the affected animal, but may also cause diseases of distant organs

(DeBowes *et al* 1996). The bacteria of dental plaque are capable of initiating the mechanisms of destruction of periodontal tissues (Attstrom and Egelberg 1971, Hoffmann *et al* 1995). The bacteria not only cause disease in the mouth, they can also cause bacteremia which may lead to heart, kidneys, liver diseases and other systemic problems. Therefore removal of calculus is an extremely important step in prophylaxis and treatment of periodontal disease. Conventional therapy routinely involves pre-surgical phase that utilizes teeth scaling and root planning combined with oral hygiene and chemotherapeutics (Lindhe and Nyman 1975, Morrison *et al* 1979, Tholen 1982a, Drisko 1996, Grove 1998, Cleland 2000). Dental tartar is treated with manual scaling (Bowersock *et al* 2000), ultrasonic scaling and combination of both (Neilsen *et al* 2000) and then followed by food management along dental exercise.

Overt bacterial infections are rarely seen, but the inflammatory response which they elicit in the gingival tissue is ultimately responsible for a progressive loss of collagen attachment of the tooth to the underlying alveolar bone. The consequence is the loosening or loss of the tooth (Loesche and Grossman 2001).

Mandible and maxillofacial fractures account for 1.5% to 3% of all fractures in dogs and 15% to 23% of fractures in cats (Umphlet and Johnson 1990). Fractures of the maxilla are relatively rare compared with mandibular fractures. These are traumatic origin as a result of dog fight, motor vehicle trauma or blunt trauma. Out of this dog fight is most common cause (Lopes *et al* 2005, Kitshoff *et al* 2013a). Most of patients are related to young age group and almost 50% of affected dogs are below 1 year of age (Umphlet and Johnson 1990).

The main purpose of the repair should be to prevent damage to soft tissue and dental structures and to provide ideal anatomical reduction (Verez-Fraguela and Vives Valles 2000). Mandibular fracture repair presents several unique problems compared to long bone fractures like presence of teeth in fracture line, loss of mandibular function results in lack of intake of fluid and food. The curved contour of mandible makes several orthopedic implants unsuitable for their application and more chance of failure. The other challenges faced by the veterinarians include non-availability of proper devices, high cost of instruments and implants, unsuitability of implants due to large variation in the size of the mandible within the species of animal.

Mandible fractures have been treated with various methods like orthopedic wiring, bone plating (Boudrieau 2004), intramedullary pinning, external taping, external fixation (Marcellin 2004) and acrylic adhesive (Muir and Gengler 1999). The complication rate of treatment for jaw fractures however, is high at 34% (Umphlet and Johnson 1990). Nearly 2/3rd of those complications involve dental malocclusion or osteomyelitis.

Information on oral disorders in pets is far from complete. Site prevalence and severity of affections is rarely assessed. Available extensive epidemiological studies concerning dental disorders in humans could serve as a model for such research in animals (Genco *et al* 1998).

No systematic work has been undertaken on veterinary dentistry under Indian conditions. So the present study was planned with the following objective:

1. To study the occurrence and surgical management of dental and mandibular affections in dogs.

CHAPTER II

REVIEW OF LITERATURE

The review of literature is divided into two parts according to the area of involvement.

2.1 Dental affections

2.2 Mandible fractures

2.1 Dental affections:-

Bauer *et al* (1966) introduced the development of standardized methods for antimicrobial sensitivity test using the disc diffusion system. However it was stated that the susceptibility results did not always correlate with the patient's response to therapy as the response to an antimicrobial agent had a complex relationship of host response, drug dynamics and microbial activity.

Tholen (1982b) enlisted the principles that one should adopt to ensure successful oral surgery and accordingly established a protocol for tooth extraction. Guidelines were stipulated for the procedures of single tooth extraction and multiple extractions as well as the closure of the resultant wounds to hasten healing. Various possible complications and the procedure to combat each one of them were described.

Hamp *et al* (1984) determined the type and frequency of dental diseases and disorders in 162 randomly selected dogs available for necropsy. The oral cavity was examined macroscopically and missing teeth, dental caries, dental calculus (tartar) and gingival epulides were recorded as to frequency and distribution. It was noted that most common disease was periodontitis, which increased in frequency and severity with increasing age of the dogs. The disease varied markedly among and within different breeds. Small dogs were more often affected with periodontitis than large dogs. Periapical destruction was a common finding. Caries and root resorption were less common. Missing teeth was a frequent disorder regardless of age. Most of the dogs had dental calculus.

Duke (1989) demonstrated through a trial on twenty dogs of different breeds that a chewing device like a flexible urethane bone could reduce the supra-gingival

calculus and thus enhanced oral health. It was advised to provide a chew bone for dogs to retard the incidence of plaque and dental tartar on the teeth.

Isogai *et al* (1989b) stated that the dental lesion was more severe and more frequent in the premolar and molar regions than in the maxillary and mandibular incisor regions and it increased with age. An increased prevalence and severity of dental calculus with advancing age was also reported.

Emily and Penman (1990) stated that the most important part of treatment of periodontal disease should be directed towards dental prophylaxis, the supra-gingival scaling, sub-gingival curettage and polishing of teeth. Plaque and all other debris containing bacteria, food particles and epithelial cells must be removed from the teeth in an effort to stop the progression of the disease. The tooth surface must then be restored to the natural perfect smoothness leaving no rough surface to encourage the adherence of plaque. The use of ultrasonic, sonic and rotosonic scalars for the removal of supra-gingival tartar was advised. However it was cautioned that while doing sub-gingival curettage, one should be careful not to cause thermal injury to both, hard and soft tissue.

DeMeijer *et al* (1991) conducted a survey to gain an insight into the prevalence of dental disease in dogs and cats and forms of dental treatment, a postal survey was conducted among veterinarians in the Netherlands. Seventy per cent of the veterinarians replied that they made routine oral examinations of dogs and cats. Of dental diseases observed in dogs and cats periodontal diseases were stated to be the most common dental problem. Dental treatments, such as removal of calculus and extractions, were performed by nearly all veterinarians. Fifty per cent of the veterinarians asked for assistance of a dentist when a dental treatment could not be carried out by them.

Skrabalak and Looney (1993) described a clinical case of a 4 year old, male Bull Terrier in which facial swelling was associated with the presence of a supernumerary tooth. It was stated that the position of the tooth could result in localized inflammation attributable to food impaction and occlusal trauma, and also resulted in periodontitis.

Harvey *et al* (1994) examined 1350 dogs under general anesthesia at veterinary hospitals in the USA and Canada. The periodontal health was recorded in

detail. Calculus was most extensive on the upper fourth premolar and molar teeth. Missing teeth, mobility of remaining teeth, extent of calculus and gingival inflammation, and furcation exposure and attachment loss all were more common in small dogs compared with larger dogs, and in older dogs compared with younger dogs.

Harvey *et al* (1995) did a comparison of sub gingival bacteria culture results in dogs and cats with gingivitis. Aerobic and anaerobic sub-gingival bacteria were cultured and identified from 49 dogs and 40 cats with spontaneous gingivitis. The most common organisms were gram-negative anaerobes (37% of canine isolates and 39% of feline isolates) and gram-positive aerobes (36% of canine isolates and 29% of feline isolates). No major differences were found between the sub-gingival floras of dogs and cats with gingivitis.

DeBowes *et al* (1996) evaluated 45 mixed breed dogs for the presence and extent of periodontal disease so as to determine the relationship between the extent of periodontal disease and histopathological changes in the tissues examined. In the forty-five dogs studied, an association was found between periodontal disease and histopathological changes in kidney, myocardium (papillary muscle), and liver and therefore established clinical-evidence of the systemic effects of periodontal disease.

Pacharinsak (1997) studied the effect of soft and hard diets on the disease of teeth and reported 95.6% and 4.4% of cases of dental calculus in 119 crossbred dogs maintained on soft and hard diets respectively.

Rawlings and Culham (1998) conducted a study to examine the cause and effect of halitosis in dogs with the aim to establish an appropriate methodology for assessing bad breath and oral hygiene. Eleven dogs of different ages and breeds fed on different commercial diets were subjected to testing. The study concluded that there was a positive link between halitosis and periodontal disease.

Gorrel and Bierer (1999) evaluated the long term effects of a dental hygiene chew on the periodontal health of dogs. It was stated that oral malodor, calculus and plague scores were still significantly lower after 21 months in the group that was receiving the dental hygiene chew, although gingivitis scores no longer differed significantly. It was further concluded that feeding of dental hygiene chew six days

per week reduced accumulation of dental deposits; helped maintain periodontal health and increased the time interval between professional periodontal interventions.

Bellows (2000) treated case of persistent sneezing due to a tooth foreign body in a 9 month old dachshund and the author demonstrated the importance of an intra-oral dental radiographic examination for correct diagnosis.

Grove (2000) stated his views on periodontal disease and its treatable aspects and recommended professional scaling of teeth as a preventive method or as a treatment for mild disease. The use of chlorhexidine as the most effective oral antiseptic in the treatment of cases of periodontal disease was recommended.

Verez-Fraguela *et al* (2000) conducted an experimental study on the effects of ultrasonic dental scaling on pulp vitality in dogs and concluded that the application of an uncooled ultrasonic scaler for 90 seconds did not increase the temperature of the dentin. However, damage comparable with acute pulpitis resulted as a consequence of the ultrasonic effect, similar to the effects produced by the 45-47°C heat applied in the control animal.

Kuntsi-Vaattovaara *et al* (2002) evaluated the results of root canal treatment in dogs and concluded that treatment was considered successful if the periodontal ligament space was normal and there was cessation of any preoperative root resorption present and the treatment was considered a failure if a peri-apical lesion or root resorption developed subsequent to endodontic treatment.

Forsblom *et al* (2002) attempted to characterize the aerobic gram-negative bacteria present in the sub-gingival sites of dogs and their role as potential bite wound pathogens. The micro flora in the sub-gingival sites of 16 pet dogs suffering from naturally occurring periodontitis was reported. The 98 canine isolates represented 20 different species or groups including 5 unidentified isolates. Out of these, 60% were fermentative and 40% were non-fermentative. It was further concluded that conventional biochemical testing could identify most of the fermentative bacteria while the non-fermentative bacteria were difficult to identify.

Niekerk (2002) reported that Dental procedures made up 3% of the Onderstepoort Veterinary Academic Hospital's total caseload, while in the private hospitals they made up 9.5% the figure for surgical and out of this dental extraction cases seems to be very low in both the private hospitals.

Patil (2004) studied 60 clinical cases of oral diseases at Bombay Veterinary College. Out of which 50 cases of periodontal disease were studied for prevalence and epidemiology. It was reported that out of total 60 cases of oral affections 83.33% (50) cases were of periodontal disease. It was further reported that 12% cases had mild, 48% had moderate and 40% had severe periodontal disease. The age wise prevalence of periodontitis showed 8% cases in 0 to 3 year age group, 24% in 3 to 8 year age group and 68% cases in 8 to 15 year age group. The percentage of cases of periodontal disease were recorded to be 54% in male dogs and 46% were in females. Further, 56% cases of periodontal disease in small breeds of dogs, 28% cases in medium sized breeds and 16% cases in large sized breeds were recorded. Out of 50 cases of periodontal disease studied 48% were on strict vegetarian diet and rest 52% dogs were maintained on mixed type of food and from the latter group 68% were provided homemade food whereas 32% were fed commercial pet food.

DuPont (2005) studied the prevalence of periodontal disease and noted that it ranged between 65%-80% in adult dogs and cats, it was one of the most common diseases and it was very preventable. It was further stated that plaque control would be hallmark of prevention of periodontal diseases.

Kyllar and Witter (2005) studied 408 dogs which came to the clinic, out of which 348 dogs (85.3%) were found positive for dental alterations. The most frequent diseases were (i) periodontitis (60.0% of 408 dogs), (ii) calculus (61.3%), (iii) missing teeth (33.8%), and (iv) abnormal attrition (5.9%). Furthermore, single cases of caries, tumors and enamel hypoplasia were observed. Periodontitis occurred preferentially in the upper jaw of small dogs and increased with age. However, the upper jaw showed a higher degree of affection than the mandible. On the labial side of the teeth, a thicker calculus layer was observed than lingual side. It was observed that the degree of calculus formation and of periodontitis did not correlate in all cases, supporting the hypothesis that supra-gingival calculus is not an irritant to gingiva.

Kumar *et al* (2008) stated that precise and scientific examination of oral cavity should be a part of routine physical examination after 4 years of age, to prevent major diseases of teeth. The incidence of dental tartar 74 (80.43%), followed by dental caries 8 (8.70%), sporadic cases of oral tumors 2 (2.17%), gingival hyperplasia 3 (3.27%), dental fistula 2 (2.17%) and fracture of mandible 2 (2.17%) were reported.

Kortegaard *et al* (2008) did an epidemiological study to estimate the prevalence and extent of severity of periodontal disease and associated periodontal parameters in beagle dogs. It was found that periodontal disease in terms of clinical attachment loss greater than equal to 1 mm and pocket depth greater than equal to 4 mm was common in beagle dogs, but the major disease burden was carried by only a few dogs. The prevalence increased with increased age but was already high at the age of two years.

Lavy *et al* (2009) studied a positive correlation between the total number of supra-gingival bacteria and the environmental conditions in which the dogs were raised. The dogs, in which high levels of caries causing bacteria were found, are at high risk for dental disorders especially caries, tartar and halitosis. It was also stated that the type of food was found to play an important role in the potential for dental health problems of dogs and according to their study about 18% of the bacteria from salivary samples of dogs were streptococci, while actinomyces species were the most abundant ones (25%).

Peddle *et al* (2009) studied the association of periodontal disease, oral procedures and other clinical findings with bacterial endocarditis in dogs. It was concluded that there is no evidence of an association between bacterial endocarditis in dogs and either dental or oral surgical procedures or oral infection. The findings suggested that the routine use of prophylactic antimicrobial administration in dogs undergoing oral procedures needs to be reevaluated.

Bota *et al* (2010) concluded that microbial load differs in relation to the stage of periodontal disease. It was stated that from entire population of bacteria in oral cavity, 22% were Staphylococcus spp., 50% Streptococcus spp. and E.Coli, 55.55% Neisseria, 27.77% Candida, Proteus spp. and Fusobacterium spp., 16.66% Corynebacterium spp., and 5.55% Pseudomonas.

Ebrahimi *et al* (2010) investigated aerobic bacteria of the oral cavity of 50 apparently healthy dogs and cats (25 and 25). From a total of 100 samples collected for bacteriological examinations, 159 (83 from dogs, 76 from cats) bacterial isolates representative of different genera were identified. More prevalent identified bacteria from cats and dogs were staphylococci (30.2, 60.3%), streptococci (31.6, 21.7%) and

Bacillus spp. (7.9, 6%) respectively. Gram positive bacteria were dominant in this environment.

Ranjan *et al* (2010) conducted a study to determine the epidemiology of periodontal diseases in dogs. During the study of oral cavities of 103 dogs older than 6 months were examined and details about feeding practices were recorded. Overall prevalence of periodontal diseases recorded was 68.9% within a breed, prevalence was high in Spitz (78.45%), Pomeranian (70%), Labrador (62.06%), Mongrel (75%), other non-descriptive breeds (68%) but low in German Shepherd, Dalmatian and Boxer breeds (50% each). In general, dogs given non vegetarian diet appeared to suffer less than those given only vegetarian diet. Dogs given only vegetarian diet had highest prevalence (75.5%) of dental problems, followed by those given a combination of vegetarian and non-vegetarian diet (65.5%), a combination of both and commercial food (60%), a combination of vegetarian and commercial food (55.56%) and vegetarian and egg (25%).

Rawlinson *et al* (2011) studied the association of periodontal disease with systemic health indices in dogs and the systemic response to treatment of periodontal disease. It was concluded that the increasing severity of attachment loss was associated with changes in systemic inflammatory variables and renal indices. A decrease in CRP concentration after treatment was correlated with the severity of periodontal disease. The BUN concentration increased significantly after treatment of periodontal disease.

Cave *et al* (2012) studied the systematic effects of periodontal disease in cats. The severity of periodontitis was associated with age, bodyweight, total globulins (Globs), Alanine aminotransferase, and IgG, and negatively associated with albumin, haemoglobin, haematocrit, and Aspartate aminotransferase (AST). Treatment significantly reduced IgG, total Globs, AST, and eosinophils, and increased cholesterol. Other leucocyte assays and plasma MDA concentrations were not affected by the treatment. It was concluded that periodontitis is not simply a localized disease, but also impacts systemic health and wellbeing.

Kouki *et al* (2013) conducted a survery to assess the local and systemic consequences of periodontal diseases. It was concluded that chronic periodontal disease does not cause anemia or a reduction in serum albumin but active periods of

periodontal inflammation may be associated with laboratory values suggestive of a systemic inflammatory response.

Marshall *et al* (2014) conducted a longitudinal assessment of periodontal disease in 52 miniature schnauzers and concluded that with no oral care regime, the early stages of periodontitis develop rapidly in this breed. It was further stated that an oral care regime and twice yearly veterinary dental health checks should be provided from an early age for this breed and other breeds with similar periodontitis incidence rates

2.2 Mandible fractures

Lantz and Salisbury (1987) suggested partial mandibulectomy for the treatment of mandibular fractures in dogs. Partial mandibulectomy was performed in 8 dogs with open or infected mandibular fractures because of economic restriction, osteomyelitis or severe bone and soft tissue injury. 6 dogs ate voluntarily by the second day after surgery and 2 dogs required pharyngostomy tube feeding for 2 to 6 days. Complications included oral wound dehiscence (3 dogs), shifting of the mandible toward the operated side (6 dogs) and drooping of the tongue (2 dogs). Slight malocclusion was of no consequence. Mandibular function was maintained in all dogs.

Umphlet & Johnson (1988) studied 75 mandibular fractures in 62 cats. Mandibular fractures comprised 14.5% of all fractures seen in cats. Automobile trauma was the cause of injury in more than 50% of the cases. Symphyseal fractures were most common (73.3%), followed by fractures of the body (16%), condyle (6.7%), and coronoid process (4%). 67% of the fractures were stabilized with cerclage and interfragmentary wiring. Malocclusion and soft tissue infections were the most frequent complications reported in 24.5% of the cats and complication were more common in multiple and open fractures.

Bos *et al* (1989) conducted a study on 6 dogs and used bio-absorbable plates and screws for internal fixation of artificially created mandibular fractures. The plates and screws were fabricated from a block of poly L-lactide (PLLA). Plates and screws were inserted in accordance with Champy's principles on internal fixation. Clinical and radiographical follow-up and examination of the fracture site under general anaesthesia showed that all fractures healed without callus and without complications.

Ardary (1989) reported that compression plates and screws in the management of mandibular fractures was a reliable method of producing rigid internal fixation and a functionally stable fracture site. It resulted in early mandibular function, less intermaxillary fixation time, improved oral hygiene and nutrition, and maintenance of normal neuromuscular physiology. Compression osteosynthesis resulted in primary bone healing. It was concluded that compression plate and screw technique was an effective method for treatment of mandible fractures.

Roush and Wilson (1989) studied the healing of mandibular body osteotomies after plate and intramedullary pin fixation. Osteotomies were created in the left body of the mandible of nine dogs and immediately stabilized with either a six hole dynamic compression bone plate or an intramedullary pin. Cortical bone healing and vascular supply were evaluated at weeks 2, 5, and 10 by microradiography, microangiography, and correlated histology of selected mandibular slices. Perforating arterioles from the buccal mucosa maintained vascular supply to rostral mandibular segments. The mandibular body rostral to the osteotomy site and caudal to the canine tooth suffered an interruption of vascular supply that was replaced by a temporary extraosseous supply during healing of the osteotomy. Intramedullary pin placement resulted in destruction of rostral teeth. There was an inflammatory response around the rostral portion of all intramedullary pins. Osteotomy sites involving tooth roots resulted in no disruption of the normal vascular or neural structures of the tooth pulp.

Umphlet and Johnson (1990) studied 157 mandibular fractures in 105 dogs. They reported that in dogs, mandible fracture accounts 2.7% of all fractures and it was most frequently seen in male dogs less than 1 year of age. Automobile trauma was the most common cause. The majority of fractures involved the premolar (31%) or the molar (18%) regions and 113 fractures (72%) were open. 142 fractures were stabilized, with tape muzzles being the most common method. Postoperative complications (34%) included dental malocclusion, osteomyelitis, bone sequestration, delayed union, malunion and nonunion. Rates of complication are influenced by many factors. Two major factors include fracture type and location. Comminuted fractures with significant bone loss have an increased likelihood of malunion and nonunion. Acceptable cosmetic and functional results were achieved in 89 dogs (85%). Fractures in the rostral portion of the mandible had shorter average time to clinical union than

other mandibular fractures. Caudal mandibular or ramus fractures carried a worse prognosis than a more rostral injury.

Rudy and Boudrieau (1992) advocated the use of interfragmentary wiring for the management of mandibular fractures. It was frequently found to be difficult to prevent interdental wire from slipping because of the shape of the dogs' teeth and this technique should be used along with other techniques for better fixation and to reduce chances of complications.

Bennett *et al* (1994) used dental composite for the fixation of mandibular fractures and luxations in 11 cats and 6 dogs. The canine teeth were pumiced, acid etched and aligned with dental composite. Six weeks after surgery the composite was removed. In 1 dog in which the fracture was not healed, the composite was replaced. The composite broke before 6 weeks in 8 animals; 2 required replacement of the dental composite. There were no other complications. The median time for fracture healing was 6 weeks.

Hou and Yeh (1994) repaired a bilateral mandibular defect with a free vascularized coccygeal vertebra transfer in a male mongrel. On the left side, a free vascularized coccygeal bone graft that included the median caudal artery and caudal vein was used to correct the defect and on the right side, the defect was bridged with a bone plate and screws. Radiographs taken at 2 months and 18 months postoperatively showed bony union with graft hypertrophy in the left mandible, whereas the right mandibular defect showed protracted nonunion. It was concluded that vascularized coccygeal vertebra transfer provided an alternative for the management of canine mandibular defects.

Kern *et al* (1995) used three techniques, 1st monocortically applied bone plates, 2nd interdental fixator composed of an erich arch bar and acrylic and 3rd A type I external skeletal fixator. On the immediate evaluation of hemimandibles stabilization, osteotomy gap distance was greatest in interdental fixators, followed by external skeletal fixators and least in bone plates. No significant difference was observed in mandibular alignment in all the techniques. By week 16, no significant differences in osteotomy gap distance were detected between groups.

Boudrieau and Kudisch (1996) conducted a case study in 15 dogs and 3 cats, using miniplate fixation for repair of mandibular and maxillary fractures. All but one

of the fractures healed with appropriate occlusion and excellent function. It was concluded that miniplate fixation, either used alone or in combination with other fracture fixation techniques, achieved sufficiently rigid skeletal fixation to provide uncomplicated healing and good to excellent functional and cosmetic results in 14 dogs and 3 cats.

Hoelzler and Holmberg (2001) treated a dog that had a comminuted, contaminated mandibular fracture on right side of body of mandible, extending caudal to the 2nd molar to the ramus. Standard fixation techniques using intramedullary pins or a bone plate to buttress the fracture would not be applicable for repair. A left side pharyngostomy was performed for intubation. A partial mandibulectomy was performed to prevent malunion and minimize postoperative morbidity. Approximately 1 cm of mandible (including the 2nd molar) was removed rostrally, while approximately 0.5 cm of mandible (including the 3rd molar) was removed caudally and it healed with slight deviation and minor malocclusion.

Cook *et al* (2001) conducted a study to determine total stiffness and gap stiffness of an acrylic external fixation system in a canine mandibular fracture gap model incorporating a full interdental pin as the only point of rostral fixation in a bilateral type-I external fixator. It was concluded that total stiffness of intact mandibles was significantly greater than that of ostectomized mandibles, regardless of external fixator configuration.

Bilgili and Kurum (2003) used mini titanium plates to repair fractures of the maxilla and mandible in 8 dogs and 3 cats, at various sites. The healing periods varied from 6 to 9 weeks. In seven cases, implants were removed after a period of 3.5 to 18 months. In four cases the implants were left in place. In ten cases the procedure was successful; however in one case the outcome was not satisfactory due to a broken plate. It was concluded that mini titanium plate fixation system was a safe and effective method for repairing certain maxillary and mandibular fractures in dogs and cats. Radiographic evidence of healing was less in external skeletal fixators at 4 and 8 weeks, compared with bone plates and interdental fixators but no significant difference in healing was seen at 16 weeks. It was further concluded that bone plating is a better technique than the other two.

Lopes *et al* (2005) performed a retrospective study in 100 dogs with 121 mandibular and 21 maxillary fractures. Dog fight (43.0%) and automobile trauma (12.0%) were the most common etiologies for fracture, while pathologic fractures occurred in 13.0% of cases. Young dogs (< 1-year-old) were most affected. Mandibular fractures occurred in 90 dogs (90.0%), with two dogs (2.2%) having concurrent maxillary fractures. Maxillary fractures only were diagnosed in 10 dogs (10.0%). The molar region (47.1%) was the most commonly affected location for mandibular fracture, followed by fractures of the symphysis and parasymphysis (30.6%), premolar region (17.4%), angular process (4.1%) and vertical ramus (0.8%). In fractures of the mandibular region, the mandibular first molar tooth was often (85.9%) involved while the canine teeth were involved in 67.5% of symphyseal and parasymphyseal fractures. The most common fracture of the maxilla was the maxillary bone (52.4%), followed by the incisive (33.3%), palatine (9.5%), and nasal (4.8%) bones.

Snyder *et al* (2009) observed that computed tomographic (CT) imaging aided the diagnosis and treatment planning for the caudal mandibular fracture. A single slice helical CT unit was used to image the dog's skull in sagittal, axial, and reconstructed dorsal images. Imaging showed an unfavorable, comminuted fracture of the right caudal Mandible at the level of the developing permanent right mandibular first (409), second (410), and third (411) molar teeth and extending through the Mandibular foramen. Inter-fragmentary wire surgical technique was used to repair this caudal mandibular fracture. Surgery was done with extra oral approach and three inter-fragmentary wires, perpendicular to fracture line were placed to ensure better fracture stability and strategically important mandibular first molar tooth was maintained. It was concluded that wire fixation method used in this case provided early return to function.

Nicholson *et al* (2010) performed treatment of caudal mandibular fracture and temporomandibular joint fracture-luxation using a bi-gnathic encircling and retaining device and concluded that this could lead to clinical union, perfect occlusion and subjectively normal jaw function, provided that case selection is appropriate and immediate post-surgical occlusion is perfect.

Marshall *et al* (2010) described the novel use of maxillomandibular circular external skeletal fixation for the repair of bilateral fractures of the caudal aspect of the mandible in a dog. Anatomic dental occlusion and reduction of the right hemimandible were achieved with mild malalignment of the left hemimandible. Fracture healing occurred within 20 days. It was concluded that CESF effectively immobilized the mandible permitting rapid fracture healing with minimal morbidity.

Mahesh *et al* (2009) treated 18 dogs having mandible fracture with 3 different techniques viz., interdental wiring, titanium mini plate fixation and gentamicin impregnated PMMA plate fixation. The fracture site was most commonly located between 2nd and 3rd premolars followed by 3rd and 4th premolars on either side. Animals started full free use of mandible 2nd day onwards when treated with bone plating and by 7th day onwards when treated with interdental wiring. It was also observed that fractures treated by PMMA plates healed by osteosynthesis, those treated with titanium mini plate healed by callus formation, and the animals treated with interdental wiring showed the problem of malocclusion and wire loosening and two animals showed uneventful recovery. It was concluded that chances of complications are least in PMMA plates, followed by titanium plating, and then wiring.

Kitshoff *et al* (2013a) studied 109 dogs with 135 mandibular fractures at small animal referral Center in South Africa and found that small breed dogs (70.6%) and dogs less than eight months of age predominated (102/109). Predisposed dog breeds were Yorkshire Terriers (16%), Dachshunds (14%), Jack Russell Terriers (11%), Maltese (10%) and Pekingese (6%). Dog fight was the most common etiology (68/109) and the molar region was most commonly affected (56/135). The majority of fractures were open (104/135) and involved teeth in the fracture line (100/135), with the first molar most frequently involved (54/135). It was concluded that the relatively big root of the first molar teeth compared to the mandibular height in small breed dogs might explain the high incidence of molar region fractures.

Kitshoff *et al* (2013b) studied the comparative biomechanics of the reinforced interdental crossover and the stout loop composite splints for mandibular fracture repair in dogs. They noted that no significant difference was found when comparing the time of application of the RIC and RIS techniques. It was concluded that in

experimentally fractured mandibles of young adult dogs there is evidence that RIC is biomechanically similar to RIS.

Verstraete *et al* (2015) treated chronic, defect non-union fractures, regenerating mandibular bone using rhBMP-2. It was concluded that mandibular reconstruction using internal fixation and CRM infused with rhBMP-2 is an excellent solution for the treatment of critical size defect non-union fractures in dogs.

CHAPTER III

MATERIALS AND METHODS

The study was conducted on cases presented to the Department of Veterinary Surgery and Radiology, College of Veterinary Sciences, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana during the period December 2014 to May 2016. It was conducted on forty five clinical cases of dogs presented for dental and mandibular affections and on 100 clinical cases of dogs presented for minor conditions like wound management, bandaging, ear infections, small tumours, etc with no pre-existing dental complaint. The cases were divided into three groups based on their presenting complaint and procedure performed (Table 1 and 2).

In group I (N=26) dental scaling using ultrasonic scaler (IM3®) (Fig. 1) and extraction procedures were performed. Based on the degree of plaque, calculus and gingivitis cases were graded from Grade 0-3 (Lobprise 2007) (Table 3). Group I was further subdivided in two subgroups which are, group IA (n=17) in which both dental scaling and extraction was done and group IB (N=9) in which dental scaling without extraction was performed.

Group II (N=19) consisted of cases of mandible fractures. Group II was further subdivided in two subgroups depending up on method of fixation. In Group IIA (N=5) only orthopaedic wiring was done while in group IIB (N=14) both orthopaedic wiring and acrylic (Protemp™ 4, 3M ESPE) (Fig. 2) as temporization material were used for fixation.

In Group III (N=100), an epidemiological study was done to find the prevalence of dental tartar in dogs in Punjab and surrounding areas. The cases in this group were randomly selected and were all above 1 year of age and were graded from Grade 0-3 (Table 3) based on the dental tartar present. The parameters recorded in this group were age, sex, breed, feed details (dry or soft food, vegetarian or non-vegetarian diet, etc), dental home care (included brushing of teeth, feeding chew sticks and artificial bones or dental supplements) and previous dental scaling history.

Table 1: Brief outline of the study conducted on dental and mandible fracture cases in dogs

Groups	Sub-Groups	Procedure Performed
Group I (n=26) Dental Scaling	Group IA (n=17)	Dental scaling and tooth extraction
	Group IB (n=9)	Dental Scaling without tooth extraction
Group II (n=19) Mandible Fracture	Group IIA (n=5)	Repair of fracture using orthopaedic wiring
	Group IIB (n=14)	Repair of fracture using orthopaedic wiring and acrylic

Table 2: Brief outline of epidemiological study conducted on 100 dogs (Group III)

Group	Parameter		Number Of Cases
Group III	Age	1-4 years	N=23
		4-8 years	N=42
		8-13 years	N=35
	Sex	Male	N=62
		Female	N=38
	Breed	Labrador	N=25
		Pomeranian	N=13
		Pug	N=10
		Others	N=52
	Diet history	Veg home food	N=16
		Non veg home food	N=13
		Commercial diet	N=51
		Mixed diet	N=20
	Dental home care	Given	N=31
		Not given	N=69
	Scaling history	Done	N=10
		Not done	N=90

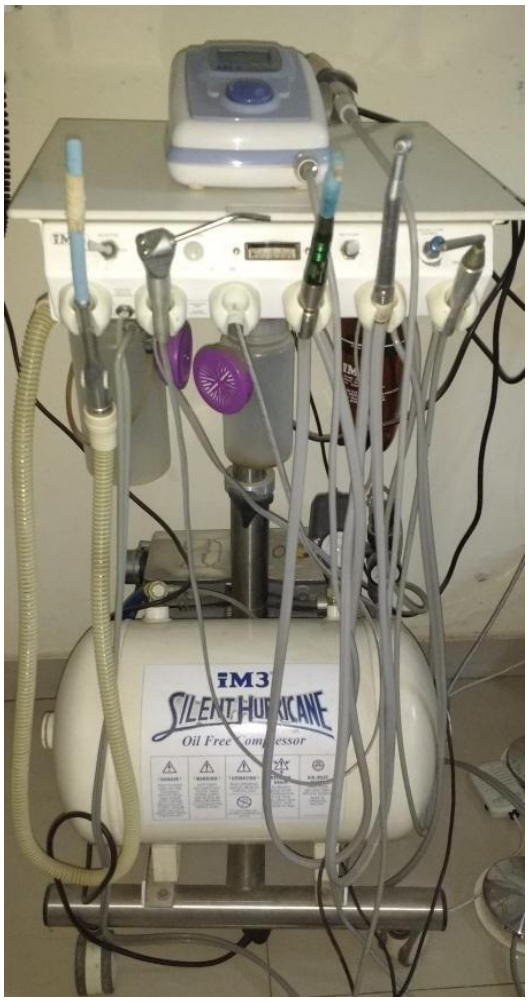

Fig. 1- IM3® stand-alone dental delivery system

Fig. 2- Protemp Garant™ Dispenser with mixing tip, used for application of acrylic over orthopedic wire for repair of mandible fracture

Table 3: Grading of the cases as per periodontal disease (Lobprise 2007)-

Grade	Clinical Signs
Grade 0	No visible plaque and calculus on the tooth surface. No gingival inflammation.
Grade 1	Plaque and calculus covers less than one-third of the tooth surface. Inflammation of gingiva but no bleeding on probing. Furcation with periodontal probe extending less than halfway under the crown and with attachment loss.
Grade 2	Plaque and calculus covers one-third to two-thirds of the tooth surface with minimal sub-gingival involvement. Moderate inflammation of gingiva and bleeding on probing. Furcation with periodontal probe extending greater than halfway under the crown and with attachment loss, but not through and through.
Grade 3	Plaque and calculus covers more than two-thirds of the tooth surface with significant sub-gingival involvement. Severe inflammation of gingiva and spontaneous bleeding present. Furcation with periodontal probe extending under the crown and passing from one side of the furcation to the other.

3.1 Observations Recorded (Group I and II)

a. **Signalment**- Information regarding age, sex, breed and weight of the animal were recorded.

b. **History**- Details about the type of feed given were noted. Medical and surgical history such as medications given, current medical conditions if any and surgeries performed thus far were recorded. Existing complaints like decreased feed intake or anorexia, halitosis, bleeding from gums, excess salivation, etc. were also noted. History of trauma or injury was recorded in case of mandible fracture cases.

c. **Physical examination**- A complete physical and oral examination was done at the time of presentation of the case.

The Triadan system (Perrone 2013) was used to number and chart the different teeth during the oral examination and dental scaling and extraction. Triadan system is a numbering system that uses three numbers to identify each tooth. The first number indicates the quadrant the tooth is in (100 is right maxilla; 200 is left maxilla; 300 is left mandible and 400 is right mandible). The next two numbers indicate the tooth, beginning from the midline out. The central incisor is 01, the middle incisor is 02, the

lateral incisor is 03, and the canine is 04; premolar 1 is 05 and molar 1 is 09. The three numbers then tell exactly which tooth is being mentioned.

Temperature, heart rate, respiration rate, body condition score (Millis *et al* 2004) (table 4), skin tenting time, capillary refill time and dental score were recorded. Normal skin tenting time and capillary refill time are 2 seconds (Yin 2010).

Table 4: Body Condition Score-

Score	Body Condition	Description
1	Thin dog	Ribs, lumbar vertebrae and pelvic bones easily visible No palpable fat Obvious waist and abdominal tuck Prominent pelvic bones
2	Underweight dog	Ribs easily palpable Minimal fat covering Waist easily noted when viewed from above Abdominal tuck evident
3	Ideal dog	Ribs palpable but not visible Waist observed behind ribs when viewed from above Abdomen tucks up when viewed from side
4	Overweight dog	Ribs palpable with slight excess fat covering Waist discernible when viewed from above but not prominent Abdominal tuck apparent
5	Obese dog	Ribs not easily palpable under a heavy fat covering Fat deposits over lumbar area and tail base Waist barely visible to absent No abdominal tuck- may exhibit obvious abdominal distension

d. **Hematology**- Blood sample was collected in EDTA vial before performing the surgical procedure to estimate the Haemoglobin, TLC and DLC.

e. **Microbiological analysis**- Oral swabs/ dental tartar/ extracted and infected tooth were collected in a sterile container from cases of dental scaling and tooth

extractions and the samples were cultured followed by antibacterial sensitivity tests using various antibiotic impregnated discs.

f. Imaging Technique- Pre-operative radiographs were taken in mandibular fracture cases. Dorso-ventral and lateral/oblique radiographic views were taken for better evaluation of fracture fragments. Immediate post-operative radiographs were taken to evaluate the alignment of fracture fragments. Radiographs were repeated at suitable intervals during follow up period for evaluation of fracture healing.

3.2 Anesthesia and Preparation of animals:

All dogs in groups I and II were premedicated using combination of Inj. Glycopyrrolate (Pyrrolate®, Neon Laboratories) @ 0.01mg/kg + Inj. Acepromazine maleate (Ilium Acepril-10®, Troy Laboratories) @ 0.05 mg/kg + Inj. Butorphenol (Butadol-2®, Neon laboratories) @ 0.2 mg/kg intramuscularly. Canulation was done to secure IV line and the dogs were administered normal saline @ 10 ml/kg/hour throughout the surgery. Anaesthetic induction was done using Inj. Propofol (Neorof®; Neon laboratories) @ 4mg/kg intravenously. Endotracheal intubation was performed with the endotracheal tubes of appropriate size and connected to anaesthesia machine (Surgivet). Anaesthesia was maintained with isoflurane (Forane®, Abbott India ltd) @ 2% in combination with 100% oxygen. The flow rate of oxygen and inhalant anaesthetic agent was maintained as per requirement (1-3%). The animals were secured in lateral or sternal recumbency depending upon the requirement of the case.

3.3 Procedure:

3.3.1 Group I (Dental Scaling) (N=26):

A chlorhexidine oral wash was done prior to the dental scaling. Grey's mouth gag (Fig. 3) was used to keep the mouth of the anaesthetized dog open.

The patient was placed in lateral recumbency and the procedure was done on one side, then the patient was rolled over and the procedure was repeated.

An ultrasonic scaler (IM3®) was used to undertake dental prophylaxis. Large deposits of calculus were manually removed using forceps (Fig. 4). Ultrasonic scaling was performed for plaque and small deposits of calculus. The side scaler was kept

parallel to the tooth surface and scaling was done by applying a light pressure and keeping the tip moving. The scaler was not kept on any tooth surface for more than 10-15 seconds and scaling was done around the circumference of the tooth. The water flow from the scaler tip prevented the teeth from getting overheated thus preventing the thermal damage to the enamel and pulp. Once scaling was completed, the teeth were dried with compressed air.

This helped in detecting any additional plaque or calculus on the teeth. The teeth were then polished with prophy paste.

Important details such as furcation exposure index (Ammons and Harrington 2006) (table 5) (Fig. 5), missing teeth, mobile teeth and fractured teeth were examined in anaesthetized dogs and documented. In cases with severe periodontal disease, furcation exposure index more than 3 and grade 2+ tartar, tooth extraction was performed.

Single rooted teeth were extracted with forceps using rotational and apical force, after breaking or exhausting the periodontal ligament. A luxator (Fig. 6) was advanced into the gingival sulcus at a slight angle to the tooth and pressed into the periodontal ligament space. The luxator exhausted the periodontal ligament fibers, aiding in tooth extraction. Dental elevator was introduced between the bone and the tooth after the luxator transected most of the periodontal ligament and the tooth had become more mobile with the alveolus. The elevator was then rotated gently and held in place to weaken and tear the remaining periodontal ligament fibers. A dental extractor was then used to grip the crown and extract the tooth from the alveolus by using gentle rotational and apical force. Multiple rooted teeth were extracted using the high speed dental burr by sectioning each tooth to multiple single rooted units and proceeding as for a single rooted tooth. A fissure burr was inserted into the furcation and the cut was extended towards the occlusal surface. The multiple rooted teeth were broken into single rooted teeth in such a way and this aided in insertion of luxator between the two units created. The single roots were then luxated and elevated using apical force as described earlier.

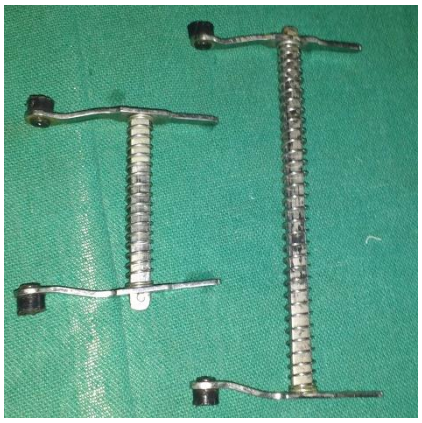

Fig. 3- Grey's mouth gag

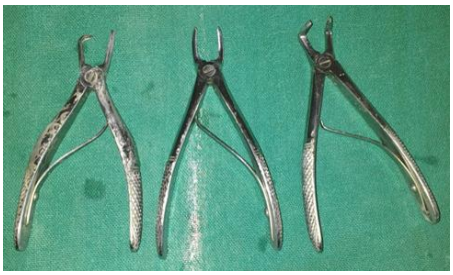

Fig. 4- Calculus removal forceps and tooth extraction forceps

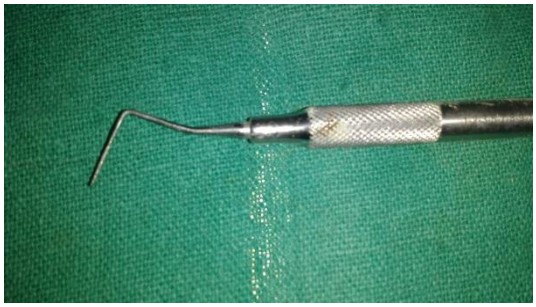

Fig. 5- Goldman-Fox probe to see the Furcation exposure index

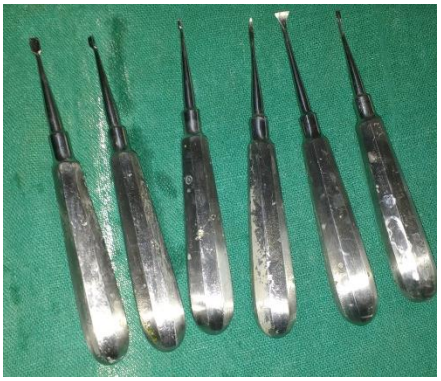

Fig. 6- Dental luxators and winged elevators

Table 5: Furcation Exposure Index (Ammons and Harrington 2006) -

FE Index	Clinical signs
F1	Can barely be probed
F2	Probe-able on one side without exit through to the other side
F3	Probe passes all the way through to the other side of the furcation, with or without soft tissue obscuring the communication
F4	Probe passes all the way through to the other side of the furcation without soft tissue obscuring the communication

3.3.2 Group II (Mandible Fractures) (N=19):

Mandible fractures were fixed surgically either by doing orthopaedic wiring or by applying acrylic (Protemp^{TM} 4) as a composite material for the fabrication of temporary restorations.

Wiring was done by drilling holes approximately 5mm rostral and caudal to the fracture site and then passing the orthopaedic wire through the hole. A hand held drill with 2.5mm size bit was used to drill the holes. For ramus fractures holes were drilled between tooth roots. Orthopaedic wiring was done as a staple suture or 8 shaped pattern for different sites of the fracture.

After wiring, acrylic was applied as an adjunct for sufficient anchorage (N=14). Teeth and metallic surfaces like orthopaedic wire were used as anchorage for acrylic. The teeth were scaled prior to fixation. The pastes were dosed and statically mixed in the dispenser. The material was applied directly over the teeth, on either side of the fracture site from the cartridge loaded in the dispenser. Acrylic was further molded with fingers to take the shape of the denture and to ensure that there were no sharp edges to cause any injury to the oral mucosa or tongue. The material attained a hard-elastic consistency within 100 seconds after the onset of mixing.

3.3.3 Group III (Epidemiological Study) (N=100)

In group III, an epidemiological study was conducted on 100 dogs above 1 year of age, presented for minor conditions like wound management, bandaging, ear infections, small tumours, etc with no pre-existing dental complaint were included in the study. The study was done to find the prevalence of dental tartar in dogs in Punjab

to know the relation between prevalence and parameters recorded. An oral examination was done and the cases were graded from Grade 0-3 (table 3) based on the dental tartar present. The animals were not sedated or anaesthetized for the examination. A basic visual examination and oral examination was done in all the cases and history was collected from the owners.

The parameters recorded were age, sex, breed, dental home care, previous dental surgical history and feed details.

3.4 Post-Operative Management

In case of dental scaling, the animal was given Tab. Clindamycin (Bioclan, SavaVet) @ 11 mg per kg body weight orally, twice daily for seven days. The owner was advised to clean the oral cavity of the dog with chlorhexidine mouthwash (Hexidine® ICPA Health Products ltd) 2 times a day for 2 weeks and then at least once every alternate day. The owner was advised to feed the dog bones, chew sticks and a mixed, balanced diet having home and commercial food.

Post-operative regime for mandibular fractures cases included administration of Inj. meloxicam (Melonex®, Intas Pharmaceuticals ltd) @ 0.2 mg/kg intra muscularly once daily for three days and inj. cefotaxime sodium (Taxim®, Alkem) @ 22 mg/kg intra muscularly twice daily for five days. The owners were advised to feed the dogs a liquid diet for initial 5 days followed by a soft diet for 2 weeks. Muzzle application was also advised up to 3 weeks post-operatively.

3.5 Follow-up

Telephonic or clinical follow up for fracture cases was done at 24 hours, 1 week, 20 days, 1 month and 2 months post-operatively wherever possible, to assess the stability of the wire and temporization material as well as to evaluate fracture healing, jaw movement and eating habits of the dogs. Any long term complication and recurrence of the clinical signs were recorded.

The acrylic and wire were removed after the fracture site healed using dental burr or a wire cutter.

3.6 Statistical Analysis:

Mean±SE values of different parameters were calculated using SPSS 16.0 and used to analyze the data.

CHAPTER IV

RESULTS AND DISCUSSION

The present study was conducted in two parts on cases presented in Teaching Veterinary Clinical Complex, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. The first part was a clinical study that consisted of 45 dogs of both sexes with age ranging from 3 months to 13 years and weight ranging from 3.2 to 68 kg, presented with affections of oral cavity and associated structures i.e. teeth and mandible, during period of December 2014 to May 2016. The second part of study was an epidemiological study done on 100 dogs between July-November 2015. The dogs above 1 year of age presented for minor conditions like wound management, bandaging, ear infections, small tumours, etc with no pre-existing dental complaints were included in the study.

4.1 Signalment

Total 45 dogs were presented with affections of oral cavity and associated structures. The cases were divided into 2 groups based on the presenting problem. Out of the 45 dogs presented, 26 cases (Group I) were related to dental tartar, and 19 cases (Group II) were related to mandibular fractures.

Breed and age wise distribution was done for all the groups (table 6 and 7).

Table 6: Distribution of the different clinical cases according to the breeds

S. No.	Breeds	Group I (N=26)	Group II (N=19)
1.	Labrador	8 (30.76%)	0
2.	Pomeranian	7 (26.92%)	0
3.	German Shepherd	6 (23.07%)	2 (10.53%)
4.	Beagle	1 (3.85%)	0
5.	Pug	1 (3.85%)	3 (15.79%)
6.	Gaddi	1 (3.85%)	0
7.	Lhasa Apso	1 (3.85%)	0
8.	Mastiff	1 (3.85%)	0
9.	Non-Descript	0	14 (73.68%)
	Total	26 (100%)	19 (100%)

Table 7: Distribution of the different clinical cases according to the age-

S.No.	Age (in years)	Group I	Group II
1.	0-2	1 (3.85%)	12 (63.16%)
2.	2-4	1 (3.85%)	2 (10.53%)
3.	4-6	2 (7.69%)	4 (21.05%)
4.	6-8	7 (26.92%)	1 (5.26%)
5.	8-10	11 (42.31%)	0
6.	Above 10	4 (15.38%)	0
	Total	26 (100%)	19 (100%)

4.2 Physical examination:

A complete physical examination included recording of the temperature, heart rate, respiration rate, body condition score, skin tenting time, capillary refill time and dental score (for Group I only). The mean±SE of each were calculated (table 8).

Table 8: Mean±SE of different physical examination parameters-

S. No	Parameter	Mean±SE	
		Group I	Group II
1.	Temperature (°F)	101.70±0.05	101.41±0.10
2.	Heart rate	97.19±2.21	104.00±1.80
3.	Respiration rate	24.62±0.83	23.26±0.78
4.	Body condition score	3.12±0.17	2.79±0.18
5.	Skin tenting time	1.73±0.14	2.05±0.16
6.	Capillary refill time	2.12±0.08	2.53±0.14
7.	Dental score	2.46±0.16	-

4.3 Hematology

Pre-operative blood sample was collected in EDTA vial to estimate the haemoglobin, TLC and DLC. Their mean±SE values were recorded (table 9).

Table 9: Mean±SE of Hb, TLC and DLC of different clinical cases-

S.No.	Hematological parameter		Mean±SE	
			Group I	Group II
1.	Hb		11.25±0.37	9.08±0.58
2.	TLC		12037.31±572.94	16056.84±1324.45
3.	DLC	Neutrophils	74.69±1.23	71.47±2.43
		Lymphocytes	23.15±1.40	27.05±2.37
		Eosinophils	4.00±0.95	2.80±0.49
		Monocytes	1.60±0.40	2.80±0.80
		Basophils	0.00±0.00	0.00±0.00

4.4 Group I (Dental Tatar; N=26)

4.4.1 Signalment

The fourteen male (53.85%) and twelve female (46.15%) dogs included in this group had an average age of 7.54±0.51 year (1-13 years) and mean body weight 23.11±2.71 kg (3.2-68 kg). However no specific reason could be attributed to the sex predilection in relation to the dental tartar. In present study 84.62% cases affected with dental tartar were above the age of 6 years and 42.31% were between 8-10years of age. This correlates to the study conducted by Sisodiya (2005), who reported 58.82% male and 68.62% cases above 6 year age affected with dental problems. Radice *et al* (2006) conducted a study in which they reported 84.6% males and 53.8% dogs between 5-10 years of age and 61.5% cases weighing above 12kgs. In our study Labrador was most commonly affected breed (Table 4), followed by Pomeranian and Germen Shepherd respectively. While Sisodiya (2005) reported Pomeranian is most commonly affected breed followed by German shepherd and Labrador. In another study conducted by Harvey *et al* (1994), it was reported that periodontal disease occurs most frequently in small breeds of dogs and its incidence increases with advancing age.

4.4.2 History

The 26 dogs with dental tartar were presented with chief complaint of halitosis. All the dogs were reported to have reduced feed intake. Bleeding from the gums was another symptom noticed in most of the cases. History also revealed that the owners were not aware that the symptoms were caused due to dental diseases. This is consistent with the findings of Livgren *et al* (1995) who stated that many owners think bad breath is natural in their pet and are not aware that periodontal disease may be the culprit. 1 dog with carnassial abscess was presented with symptoms of swelling in the suborbital region.

4.4.3 Clinical signs

Clinical signs observed in these cases included tartar deposition, plaque and calculus accumulation, halitosis, reduced feed intake, furcation exposure index, gingivitis, gingival recession, abnormal salivation, oral hemorrhage, missing teeth and mobile teeth. Similar clinical sings were reported by Kumar (2006) with different dental and oral affections. While Kesel (2000) observed halitosis, ptyalism, anorexia, behavior alterations, altered gingival colour, gingival bleeding, tooth mobility, periodontal and periapical abscesses, nasal discharge, sneezing, osteomyelitis, contact ulcers, intranasal dental migration and oronasal and oroantral fistulas.

4.4.4 Diet

The study for the dietary factors during history revealed that out of total 26 dogs with dental tartar, 10 (38.46%) were maintained on soft diet (home food), 4 (15.38%) on dry food (commercial diet) and rest of 12 (46.16 %) were maintained on mixed diet (soft plus dry food). Of the 10 dogs maintained on soft diet, 5 were given pure vegetarian diet while the remaining 5 were on a non-vegetarian diet. Colmery and Frost (1986) reported that dogs fed on soft diets had significantly more calculus formation and gingival inflammation than the hard diet-fed dogs. Moreover, the somewhat dry diet helped to eliminate plaques from teeth by requiring more mastication. Emily and Penman (1990) mentioned that chewing of bone produced large quantity of saliva, which had antiseptic action and helped in prevention of plaque and dental calculus formation. Radice *et al* (2006) mentioned that in the study conducted by them, 76.9% dogs were maintained on a mixed (soft and dry) diet. Kumar (2006) reported that in his study, 79.34% dogs were maintained on vegetarian

diet and 20.65% were maintained on mixed diet out of total dogs affected with different dental affection. Patil (2004) conducted a study on 50 cases of different dental affections and reported that 48% were maintained on pure vegetarian diet and rest 52% were maintained on mixed type of food.

4.4.5 Microbiology

In the present study, bacteriological culture of swab collected from super gingival dental area of 26 dogs with dental tartar was done (table 10). In our study staphylococcus (42.30%) (Fig. 7) was found to be most prevalent bacteria. Sisodiya (2005) also found staphylococcus was the most prevalent bacteria in different dental affections in 24.39% cases. Radice *et al* (2006) isolated streptococcus most frequently among the aerobic bacteria and it was often associated with Escherichia coli (38%) or Pasteurella multocida (38%). It was found to be susceptible to gentamycin (80%), amoxicillin + clavulanic acid (40%) and erythromycin (20%). While Dahlen *et al* (2012); Riggio *et al* (2011) found Pasteurella sps to be most predominant in their study. Allaker *et al* (1997) reported an epidemiological study in which supra-gingival plaque samples from 34 dogs were used to assess the prevalence of anaerobic bacteria and identified Porphyromonas gingivalis in 68% of the dogs. Isogai *et al* (1999) confirmed that Porphyromonas sps and Bacteroides sps are associated with periodontal disease in canines.

Table 10: Frequency of bacteria isolated from super gingival swabs of dogs affected with dental tartar-

S No.	Isolated Bacterial genera	No of cases	Percentage
1.	Staphylococcus	11	42.30%
2.	Streptococcus	8	30.77%
3.	Escherichia coli	3	11.54%
4.	Bacillus	2	7.69%
5.	Pseudomonas	1	3.85%
6.	Klebsiella	1	3.85%
	Total	26	100%

Antimicrobial drug sensitivity (Fig. 8)

In our study amoxicillin and clindamycin (76.92%) were found highest in vitro susceptibility followed by the Ofloxacin (50%) and Streptomycin (46.15%) (table 11). While Sisodiya (2005) reported in his study that amoxicillin (60.71%) had highest susceptibility followed by cloxacillin (57.14%). Golub *et al* (1995); Choi *et al* (2004); Emingil *et al* (2004a and 2004b) demonstrated that the administration of subantimicrobial dose of doxycycline after sub-gingival root planning resolved chronic periodontal inflammation. Antibiotic of choice for dental tartar and oral affections in the current study was clindamycin. Lobprise (2007) and Niemiec (2008b) stated that clindamycin, amoxicillin/clavulanate and metronidazole seemed to be particularly effective antimicrobials and could be used for a week before periodontal treatment and for 7-10 days post-operatively.

Tablet 11: Sensitivity of the isolated bacteria to different antibiotics-

S. No.	Antibiotic	Percentage
1.	Amoxicillin	76.92%
2.	Clindamycin	76.92%
3.	Ofloxacin	50%
4.	Streptomycin	46.15%
5.	Doxycycline	46.15%
6.	Ceftriaxone	46.15%
7.	Gentamicin	42.31%
8.	Colistin	30.77%

4.4.6 Surgical procedure

4.4.6.1 Group IA (Dental Scaling with tooth extractions; N=17)

Out of the 26 cases presented with dental tartar, dental scaling along with tooth extraction was performed in 17 (65.38%) cases (table 12) (Fig. 9-10). Niemiec (2008b) stated that tooth extraction is currently the final modality for PD.

Root abscess was seen in one of the cases (Fig. 11) and the affected tooth was extracted. Wiggs and Lobprise (1997) state that a class II peri-endo abscess occurs as a consequence of periodontal disease and can be seen in multi-rooted teeth. These findings are consistent with the present study. Niemiec (2008a) reported a similar case in a Labrador retriever.

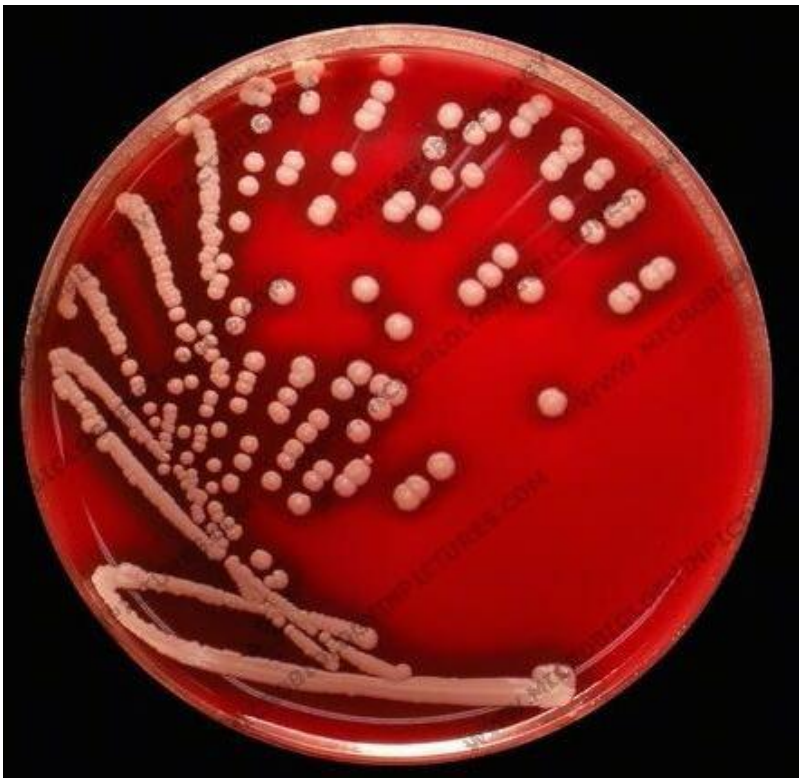

Fig. 7- Growth on blood agar media showing Staphylococcus colonies-

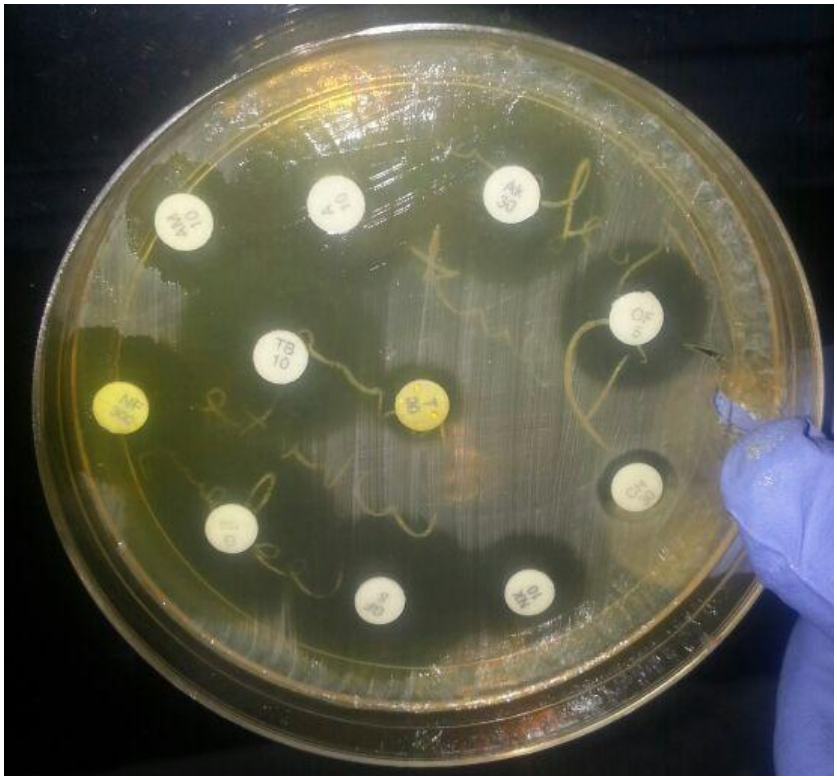

Fig. 8- Antimicrobial drug sensitivity showing different zones of inhibition-

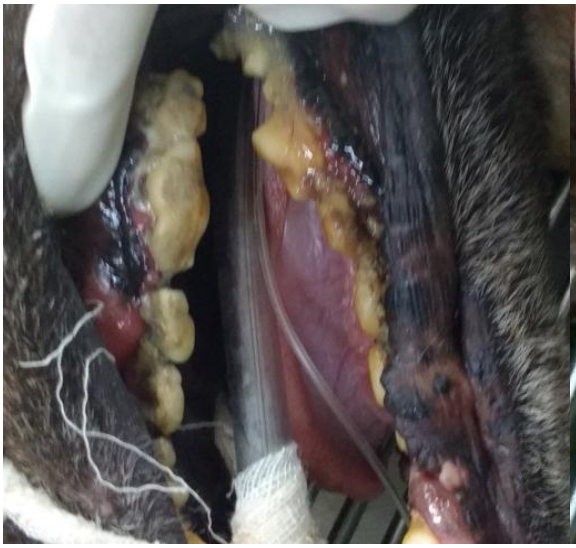

Fig. 9- Case 1- Before performing extraction of 105, 106 and 107 (mobile teeth)

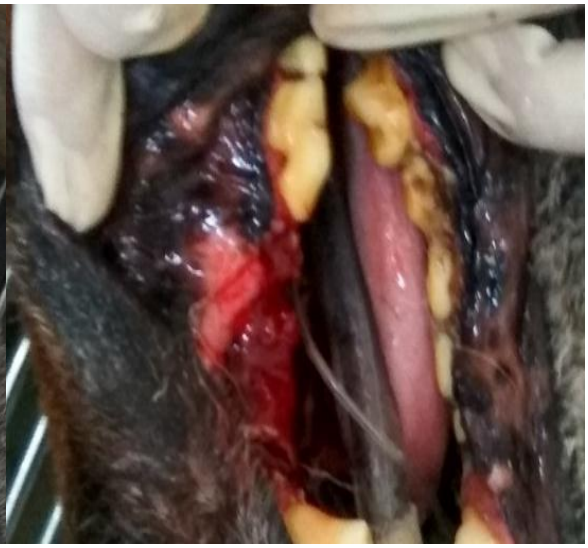

Fig. 10- Case 1- After performing extraction of 105, 106 and 107 (Single rooted teeth)

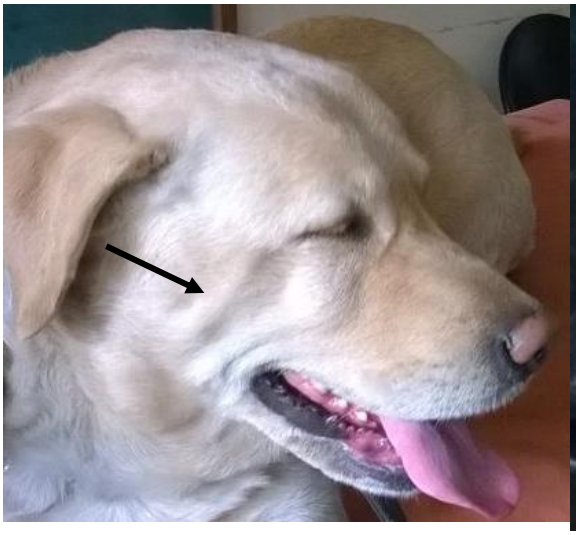

Fig. 11- Swollen muzzle (arrow) due to root abscess caused by fracture of 108

Fig. 12- Furcation Exposure Index 3 with recession of gum and exposure of tooth roots (arrow)

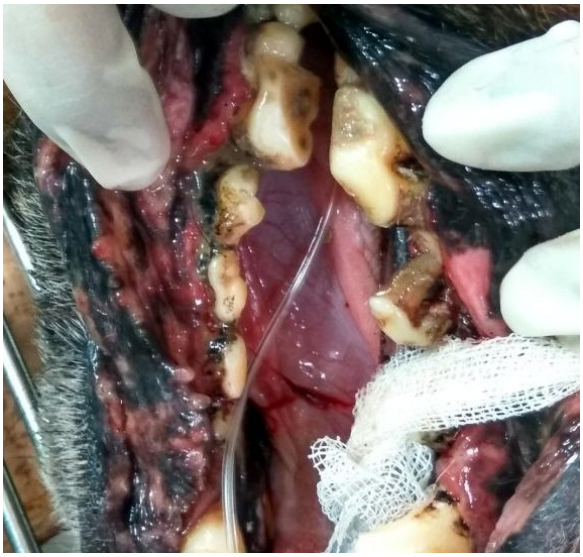

Fig. 13- Case 2- Before performing extraction of 107 and 108, showing furcation index 3+ with root exposure

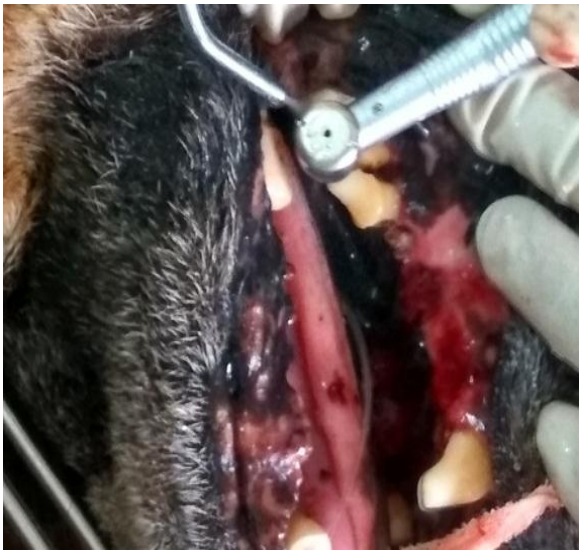

Fig. 14- Case 2- Sectioning of multi-rooted tooth (108) using burr

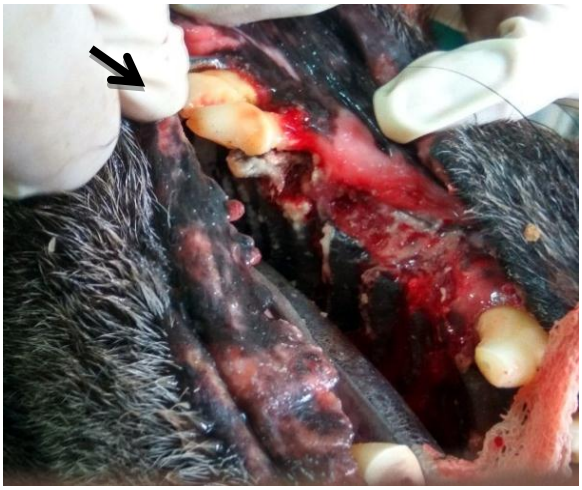

Fig. 15- Case 2- Post sectioning of multi-rooted teeth. The periodontal ligaments are being exhausted by inserting a luxator (arrow)

Fig. 16- Case 2- Teeth extracted

Multi rooted teeth with furcation exposure of more than 3 and mobile teeth were extracted (Fig. 12-16). The teeth extracted were completely loosened before extraction. This was in accordance to the findings of Verstraete (1983) who emphasized the importance of completely loosening the root from its periodontal attachment and subsequently lifting the tooth out by means of a root elevator instead of forceful extraction with an extraction forceps.

4.4.6.2 Group IB (Dental scaling; N= 9)

Dental scaling without tooth extractions was performed on 9 (34.62%) cases (Fig. 17-20). The cases presented showed furcation exposure index of 2 or less, with no mobile teeth or root exposure. Ultrasonic scaling followed by tooth polishing was performed on these cases.

4.4.7 Follow up

Pet owners were advised to feed the dogs a commercial diet and chew sticks, use diluted chlorhexidine mouthwash and brush the teeth a minimum of two times a week. Follow up after 3 – 5 months showed no reoccurrence of halitosis and dental tartar. Excessive salivation due to periodontal disease persisted until the bleeding and inflamed gingiva healed. This was accomplished within 3-5 days of scaling and the site of extraction of teeth was completely healed within 10 days.

4.5 Group II (Mandible fractures; N=19)

The following study was conducted on 34 mandible fractures in 19 dogs. Out of the 19 dogs presented, 13(68.42%) had bilateral fractures (26 mandibular fractures), 1 (5.26%) had a bilateral canine fracture as well as a symphyseal fracture and remaining 5 (26.32%) had unilateral fractures.

4.5.1 History

All the dogs were on a liquid diet at the time of presentation. Excess salivation was noted in the cases. The causes of mandibular fractures recorded were trauma due to automobile accident (57.89%), dog bite (21.05%) and fall from height (15.79%), while one dog (5.26%) was kicked by a cow leading to mandibular fracture. In one study, Wiggs *et al* (1998) found common causes of mandibular fracture to be trauma, severe periodontal disease, neoplasia, and iatrogenic fracture during tooth extraction. In our study most common cause was automobile accident followed by dog bite as supported by Umphlet and Jonsan (1990) who also reported automobile trauma to be

Table 12: Teeth extracted and reasons for their extractions along with other significant observations

S.No.	Teeth extracted	Reason	Other observations
1.	108	Root abscess and chip fracture	
2.	109, 308, 309, 408	Furcation exposure (F4) and root exposed	
3.	107, 108, 109, 206, 207, 209, 210, 308, 408	F4 and root exposed	105 missing, F2 in 407
4.	108, 109, 205, 206, 209, 210, 306, 409	F4 and root exposed with few mobile teeth	F2 in 308, 309 and 409
5.	206	Mobile tooth	101, 102, 103, 110, 201, 202, 203, 205, 209, 210, 301, 302, 303, 310, 311, 401, 402, 403 and 411 missing
6.	106	Mobile tooth	108, 109, 110, 205, 206, 208, 210, 306, 310 and 311 missing
7.	107, 206, 306, 406	F4 and mobile teeth	207 missing, F2 in 108
8.	207, 301, 403	Mobile teeth with root exposure	110, 205, 206, 208, 209, 210, 305, 306, 310, 311, 406, 407, 409, 410 and 411 missing, F2 in 108 and 309
9.	106, 201, 202, 203, 206, 207, 301, 302, 306, 401, 402	F4 and root exposed with few mobile teeth	105, 205, 210, 303, 305, 203, 405 and 411 missing
10.	107	Mobile tooth	109, 110, 209, 410 and 411 missing
11.	105, 108	Mobile teeth with crown fracture of PM4	Uncomplicated crown fracture of 104, 204, 304 and 404
12.	106, 205 and 206	Mobile teeth	105 missing, F2 in 108, 407 and 408
13.	108, 209, 409	F4 with root exposure	F2 in 107, 208, 308 and 407
14.	105, 107, 108, 205, 206, 207, 208, 407, 408, 409	F4 with root exposure and mobile teeth, complicated crown fracture of 409	106 and 110 missing, complicated crown fracture of 104, 204, 304 and 404, F2 in 109, 209, 210 and 406
15.	106, 201, 202, 203, 206, 302, 402	F4 and root exposed with few mobile teeth	105 missing
16.	105, 306	Mobile teeth	
17.	207, 306, 409	F4 and root exposed	

Fig. 17- Case 3- Before performing dental scaling in a Pug showing Grade 2 dental tartar

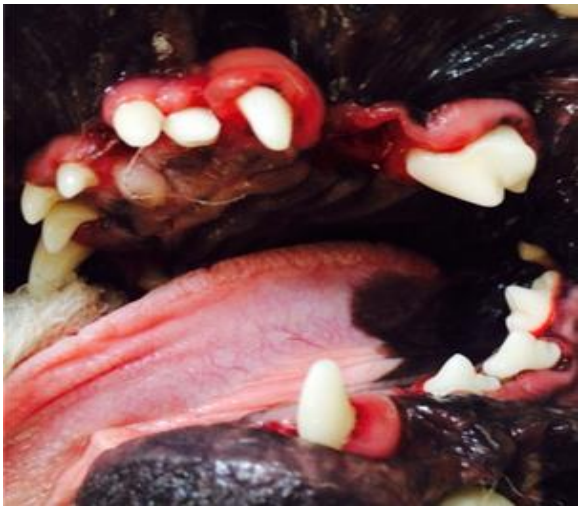

Fig. 18- Case 3- Post dental scaling and polishing

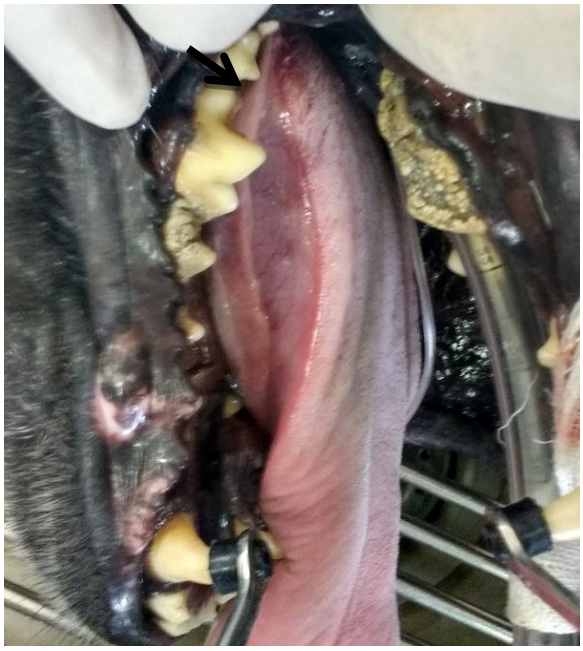

Fig. 19- Case 4- Before performing dental scaling on a dog with Grade 3 dental tartar

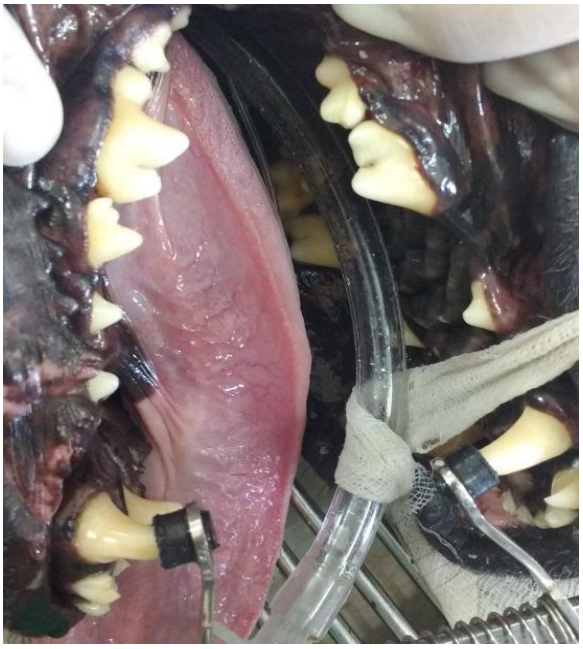

Fig. 20- Case 4- After performing dental scaling

most common cause (52.3 %) followed by dog fight (19.1%). Philips (1979) also reported trauma from motor vehicles as one of the most common causes of traumatic injury to the canine mandible. While a study conducted by Mulherin *et al* (2014) found altercations with other animals (35.8%) to be the most likely cause for mandibular fracture than trauma associated with motor vehicles (17.9%).

4.5.2 Signalment

The mean age was 1.95±0.46 years (ranging from 3 months to 7 years) and mean body weight was 10.94±1.42 kg (ranging from 3.4 to 23.5 kg) with varying clinical signs. In the present study, 57.9 % dogs presented with mandible fracture were under 1 year age. This was similar to the study conducted by Kitshoff *et al* (2013a), who reported that 57% dogs suffering from mandible and maxillary fractures were less than one year of age. Lorinson *et al* (2008) stated that the reason for this could be that the bones of dogs less than 1 year of age had less mineral content and bone density as compared to mature dogs. Mulherin *et al* (2014) reported that 33.2% dogs suffering with mandible and maxillary fractures were less than one year of age. Goeggerle *et al* (1996); Piermatti *et al* (2006) stated that almost 50% of the dogs affected with jaw fractures are less than 1 year of age.

Out of the 19 mandible fracture cases presented, fourteen were males (73.68%) and five were females (26.32%). Lopes *et al* (2005) reported a high incidence of mandible fractures in male dogs less than twelve months of age. Similarly Umphlet and Johnsan (1990) reported 60% male and 40% female dog in study of 105 dogs. This might be due to aggressive nature of male dogs. Hart and Hart (1985) also reported significantly more incidence in dogs of less than one year of age and it was speculated that younger dogs were more likely to receive traumatic injuries in general based on their activity and less obedient nature.

In our study, Indian breed (73.68%) was most commonly affected, followed by Pug (15.79%). While Kitshoff *et al* (2013a) reported that Yorkshire Terriers (16%), Dachshunds (14%), Jack Russell Terriers (11%), Maltese (10%) and Pekingese (6%) had the highest incidence of mandibular fracture.

4.5.3 Clinical sign:

The clinical sign ranged from anorexia, crepitation and mobility on manipulation, drooling of saliva, bleeding form mouth, dropping jaw, asymmetry of

jaw, protrusion of tongue, and reluctance to eat. Similar findings were reported by Hulse and Johnson (1997) in different cases of mandible fracture.

4.5.4 Site of fracture

Six anatomical regions were used to classify the mandibular fracture location (table 13). These regions were as following:

1. Symphyseal
2. Canine region
3. Premolar region
4. Molar region
5. Ramus region
6. Condylar region

Table No. 13: Site of mandibular fractures, no of dogs and their percentage:

S. No.	Site of fracture	No. of dogs (N=34)	Percentage
1.	Symphyseal	3	8.82 %
2.	Canine region	21	61.76 %
3.	Premolar region	6	17.66 %
4.	Molar region	4	11.76 %
5.	Ramus region	NIL	0.00 %
6.	Condylar region	NIL	0.00 %

Most common site of fracture was canine region (61.76%) followed by premolar region (17.66%). This was in contradiction with the findings reported by Kitshoff *et al* (2013a) and Lopes *et al* (2005) who stated that molar region was the most common site followed by premolar region. Umphlet and Johnson (1990) found premolar region to be most common affected site, accounting for 31% of mandibular fractures.

In our study 100 % fractures were open type while Kitshoff *et al* (2013a) reported 77% fracture were open type. This might be because no first aid was given by the owners which led to closed fracture becoming open. Umphlet and Johnson (1990); Piermatti *et al* (2006) stated that most jaw fractures are open with varying degrees of contamination and infection.

4.5.5 Radiography

Open mouth lateral or lateral oblique and dorsoventral views were taken to evaluate the site of fracture and type of fracture. Open mouth radiographs gave better visualization of the fracture site.

4.5.6 Surgical Procedure

The animals were divided in two groups depending upon surgical technique used to immobilize the fracture and the technique was selected on the basis of site of fracture.

4.5.6.1 Group IIA (Orthopedic wiring; N=5)

4.5.6.1.1 Follow up

All the cases in which wiring was done resulted in satisfactory reduction of fractured fragments at the time of treatment (table 14) (Fig. 21-26).

Follow up revealed that animals started taking liquid feed on the first post-operative day in 80% of the cases and started taking semisolid diet after 5-7 days. 2 dogs (40%) died due to unrelated reasons before wire removal. However, 1 of the cases showed callus formation and proper healing till the last date of follow-up. Another case was unavailable for follow up one week post-operative. In the remaining 2 cases, fractures healed completely. While Mahesh *et al* (2009) reported full use of mouth day 7 onwards. Owen *et al* (2004) stated that many jaw fractures are functionally healed in as little as 2-3 weeks with a reported average healing time between 5.5 and 6.3 weeks.

Long term follow up revealed satisfactory healing of fractured fragment with minimal callus formation. Symphyseal fractures were comparatively easy to treat with simple orthopaedic wiring.

Complete follow up was only done for 2 cases of the total 5 mandible fracture cases treated with orthopaedic wiring. Both the cases showed proper fracture healing with no malalignment.

4.5.6.1.2 Complications

Out of the 2 cases in which follow up was done till the fracture fragments healed; complications were recorded in 1 case (50%).

Pus formation was seen 2 days post-operatively. This was treated using cephalosporins. The animal regained normal feed intake within a week of the surgery.

No wire loosening was noticed in any of the cases in our study, while Mahesh *et al* (2009) reported wire loosening in 3 (50%) cases out of six cases.

Table 14: Age, sex, breed, Site of fracture, follow up and complications of cases of mandible fractures treated with wiring (N=5)

S.No.	Age, Sex, Breed	Etiology	Site of Fracture	Follow up
1.	3.5years, F Pug	Fell from height	Bilateral fracture. Between 307, 308 and between 409 and 410.	**24hrs post-op:** No bleeding. Animal comfortable with no signs of pain. **1 week post-op:** Animal shifted from a liquid diet to a soft diet. Normal appetite noticed. **20 days post-op:** Normal feed intake. Dog is able to close its mouth. Healing noticed **1 month post-op:** Callus formation noticed. **5 months post-op:** Wire removed. Proper apposition and healing noticed.
2.	3m, M Indian	Vehicular accident	Symphyseal fracture	**24hrs post-op:** No bleeding. Animal comfortable with no signs of pain or shock. **1 week post-op:** Animal shifted from a liquid diet to a soft diet. Normal appetite noticed. **20 days post-op:** Normal feed intake. Owner removed the muzzle due to lack of signs of pain or discomfort. **1 month post-op:** Mandible fracture seemed to be healing well. Callus formation noticed. **40 days post-op:** The dog died in an accident.
3.	3m, M Indian	Dog fight	Symphyseal fracture	**24hrs post-op:** Slight bleeding noticed. **1 week post-op:** No bleeding noticed. Animal seemed comfortable and in no noticeable pain. Having milk and soft food. **15 days post-op:** Animal died in another dog fight.
4.	3m, M Indian	Vehicular accident	Bilateral fracture, behind 304 and 404	**24hrs post-op:** No apparent signs of pain noticed. No bleeding seen. Animal having a liquid diet. **1 week post-op:** Animal shifted from a liquid diet to soft food. No signs of pain noticed. Muzzle application continued. Owner unavailable for further follow up.
5.	2years, F Pug	Fell from height	Bilateral fracture, between 307, 308 and 407, 408.	**24hrs post-op:** Inappetance noticed. Animal was in pain and was howling. No bleeding seen. **1 week post-op:** Owner informed about pus formation at the site. Got it checked at a local hospital and started cephalosporins. **20 days post-op:** Normal jaw movement and feed intake noticed. **2 months post-op:** Mandible fracture seemed to be healing well. Callus formation noticed. **4 months post-op:** Wire removal done. Fracture site healed well.

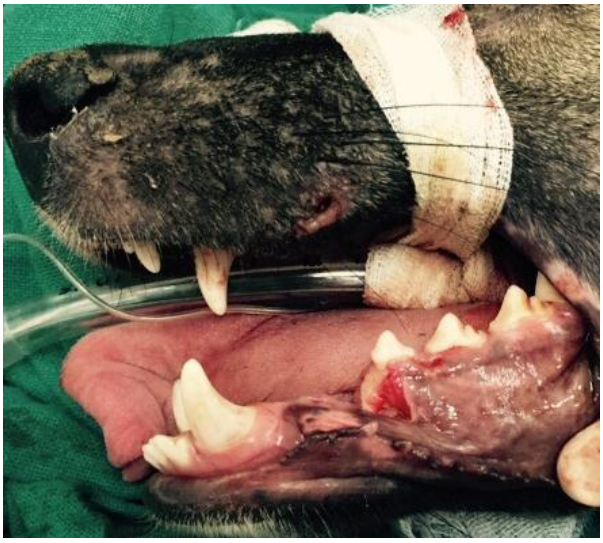

Fig. 21- Case 5- Mandibular fracture behind 304

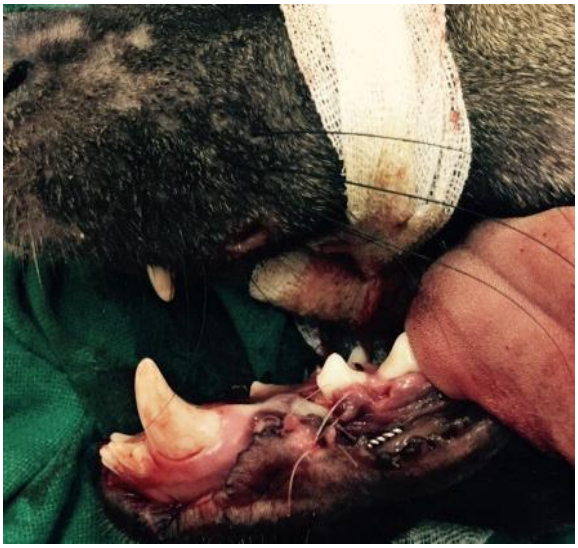

Fig. 22- Case 5- Mandibular fracture behind 304 treated with orthopaedic wiring (staple suture pattern)

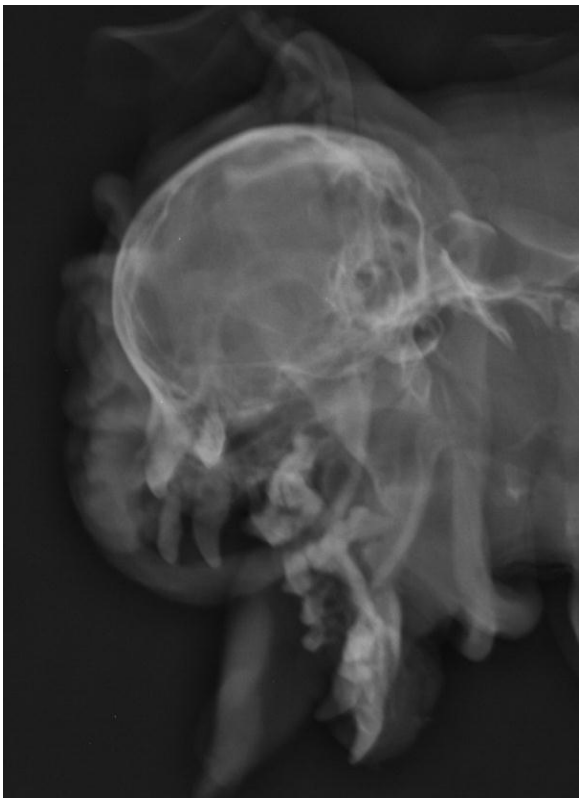

Fig 23- Case 6- Pre-op radiograph of mandible fracture between 307 and 308; 407 and 408

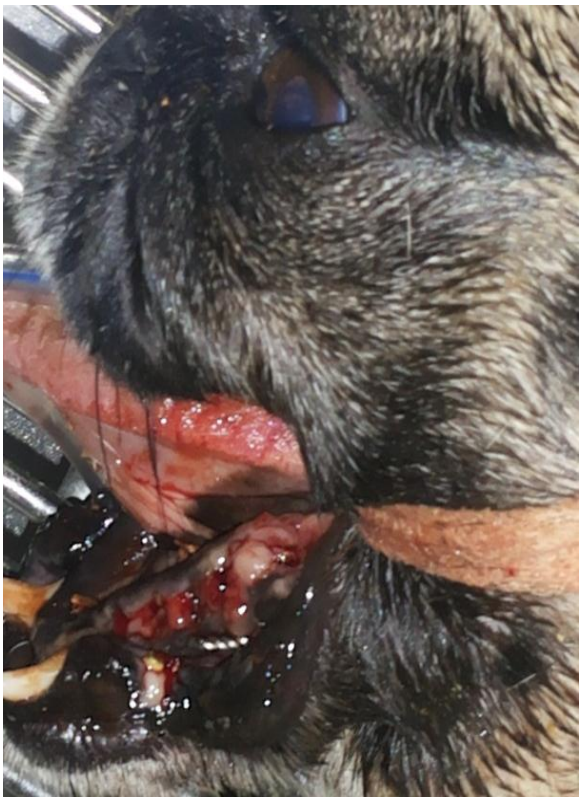

Fig. 24- Case 6- Mandibular fracture treated with orthopaedic wiring

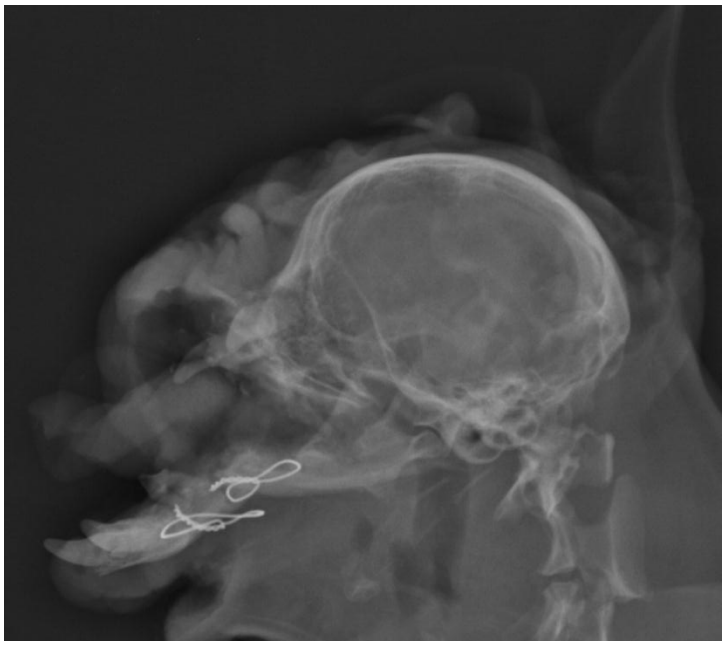

Fig. 25- Case 6- Post-op lateral view radiograph taken immediately after doing wiring

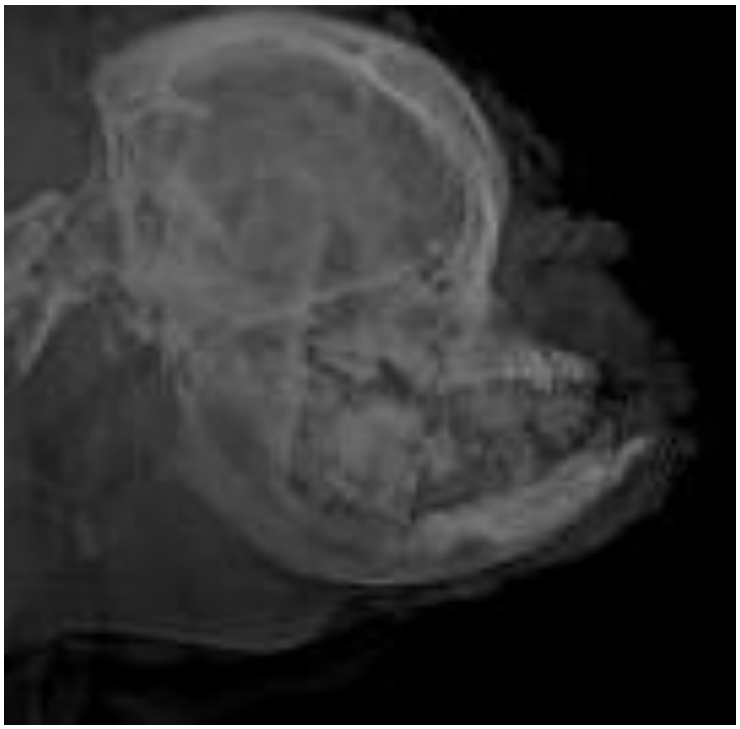

Fig. 26- Case 6- Post wire removal radiograph- lateral view of mandible (done 5 months post-operatively)

4.5.6.2 Group IIB (Orthopaedic wiring and Acrylic; N= 14)

Acrylic was used as temporization material to immobilize the fracture fragments in 14 cases (table 15) (Fig. 27-36). Teeth and metallic surfaces like orthopaedic wire were used as anchorage for acrylic. Teeth on either side of the fracture fragments were covered with the cementing material. This was in accordance to the study done by Kitshoff *et al* (2013b). However, Smith and Legendre (2012) recommend including at least two teeth rostral and two teeth caudal to the fracture site. Niemiec (2003) found that intraoral splints usually relied on the presence of intact teeth on either side of the fracture site and was best applied to mandibular fractures, especially those rostral to the molars. Niemiec (2003) also stated that interdental wiring between teeth on either side of the fracture line can help to provide accurate reduction, add additional stability to the repair, and reinforce the overlying acrylic bonding material.

It was not used as a method of fixation for symphyseal fractures as there was not enough mandibular support to bear the weight of the material.

4.5.6.2.1 Follow up

Acrylic provided additional stability to the fractured fragments and formed a hard cast around the wire and fractured site, causing proper immobilization of the site and aiding in better and faster healing of the fracture site. It was noticed that acrylic anchored better to the tooth surface if there was no plaque or calculus present on the tooth. Acrylic was found to be more useful in strays and in dogs which could not receive regular post-operative care like muzzle application and restricted jaw movement. It provided additional support to the wire and prevented it from breaking easily due to jaw movements and additional force on the mandible. It was found to have helped the patient return to normal eating habits rapidly. Similar findings were reported by Hale and Anthony (1996) who stabilized a mandibular fracture between 301 and 304 in a 6 month old German shepherd using a methyl-methacrylate splint after looping a twenty-six gauge wire around the canines to hold the fracture segment in proper occlusal alignment during splinting. It was stated by Hale and Anthony (1996) that the use of an acrylic splint to stabilize the fracture segment gave adequate immobilization to allow healing without causing damage to any deep structures. Manfra-Marretta *et al* (1990); Mulligan (1991);

Harvey CE and Emily PP (1993b) reported that the use of directly placed acrylic splints has been well described, requires little special equipment and is relatively quick and simple to carry out.

Follow up was not done for longer than a month in 4 cases (28.57%) as the dogs died due to various unrelated causes. However, till the time of follow up, the fracture site seemed to be healing well in 3 cases, with sufficient jaw movement and normal eating habits. In 1 case the ceramic loosened and fell off and re-wiring had to be done.

The remaining 10 cases were followed up till the fracture sites healed. In one (10%) case re-wiring had to be done due to loosening of ceramic and wire. Acrylic was found to be successful in the remaining cases (90%) with proper healing of fracture fragments, minimum callus formation and normal jaw movement.

4.5.6.2.2 Complications

Minor complications were seen in 3 cases (21.42%). Slight radiographic malalignment of the fracture fragments 20 days post-operatively was noticed in one case. The acrylic was removed and rewiring was done in the case. Manfra-Marretta *et al* (1990); Umphlet and Johnson (1990) reported a 34% complication rate for mandibular fracture repair, with malocclusion being the most common followed by other complications like delayed union, malunion, bone sequestration and osteomyelitis.

In one case the wire loosened one week post-operatively as the owner did not use a muzzle as advised. The ceramic became loose and fell off and rewiring was done under general anaesthesia. Similar complications were seen by Kitshoff *et al* (2013b), who reported failure of implant in all cases due to fracturing of the composite over the osteotomy site or between the first and second molar teeth, followed by detachment of the resin from the lingual enamel surface of the first molar.

Pus formation at the fracture site was reported by one of the owners due to negligence to continue post-operative antibiotics as prescribed and possibly due to infection because of the dog bite. The wire loosened 5 days post-operatively due to the dog chewing on some furniture and due to the reluctance by the owner to use a muzzle. Wire was tightened under general anaesthesia. Necrosis of part of left ramus was noticed and the bone was trimmed from the 3rd incisor the the 1st pre-molar.

Table 15: Signalment, etiology and follow up of all the cases treated with acrylic (N=14)

S. No	Age, sex	Etiology	Site of fracture	Follow up and wire removal				
				24hrs post-op	1 week post-op	20 days post-op	1-2 months post-op	Wire and Acrylic removal
1.	1.5years, M	Vehicular accident	Unilateral fracture behind 404.	Implant stable. Having liquid diet.	Implant stable. Radiographs not taken. Shifted to soft diet.	Implant stable. Radiographs not taken. Jaw movement normal.	Healing noticed radiographically, slight loosening of wire seen, tightened under sedation.	**<u>3 months post-op:</u>** Fracture site healed. Wire and acrylic removed.
2.	6m, M	Dog fight	Bilateral mandibular fracture behind 304 and 404.	Implant stable. Inappetance noticed. IV fluids administered to combat dehydration.	Implant stable. Radiographs not taken. Having liquid diet.	Implant stable. Radiographs not taken. Jaw movement normal. Having soft food.	Healing noticed radio-graphically.	**<u>3 months post-op:</u>** Fracture site healed. Normal jaw movement noticed. Wire and acrylic removed.
3.	7m, F	Kicked by a cow	Oblique rostral mandibular fracture behind 304 and 403 with complete separation of 304 and its root from the caudal mandible. Slight tissue loss noticed.	Implant stable. Having liquid diet.	Implant stable. Radiographs not taken. Shifted to soft diet.	Fracture site healing well	Owner unavailable for a follow-up.	**<u>6 months post-op:</u>** Fracture site healed with sufficient callus formation. Slight malalignment seen at the left side of the mandible. Acrylic and wire removed.

S. No	Age, sex	Etiology	Site of fracture	Follow up and wire removal				
				24hrs post-op	1 week post-op	20 days post-op	1-2 months post-op	Wire and Acrylic removal
4.	1year, M	Vehicular accident	Bilateral mandibular fracture behind 304 and between 405 and 406.	Implant stable. Slight reduction in appetite.	Owner unavailable for a follow-up.	Owner unavailable for a follow-up.	Dog died in an accident.	
5.	6m, M	Dog Fight	Bilateral fracture behind the 304 and 404.	Inappetance noticed. Animal was in pain and was howling. No bleeding seen.	Loosening of wire and pus formation at the site- possibly due to infection because of dog bite. Advised to bring the dog in for a check-up.	Wire became lose 15 days back Wire tightened under sedation. Necrosis of part of left ramus noticed and the bone was trimmed from 303 to 305.	Fracture site healing well. Callus formation seen. Normal feed intake present.	**3 months post-op:** Owner unavailable for wire removal
6.	4years, M	Vehicular accident	Bilateral mandibular fracture caudal to the 304 with entire canine root exposed and cranial to the 404.	Implant stable. Having liquid diet.	Implant stable. Having soft diet.	Fracture site healing well.	Normal feed intake. Fracture site healing well.	**3 months post-op:** Fracture site healed. Normal jaw movement noticed. Wire and acrylic removed.
7.	7years, M	Vehicular accident	Bilateral mandibular fracture behind 304 and 404.	Implant stable. Having liquid diet.	Implant stable. Shifted to soft diet.	Fracture site healing well.	The dog died in another accident.	

S. No	Age, sex	Etiology	Site of fracture	Follow up and wire removal				
				24hrs post-op	1 week post-op	20 days post-op	1-2 months post-op	Wire and Acrylic removal
8.	8m, M	Vehicular accident	Bilateral mandibular fracture between 307 and 308; 307 and 408	Implant stable. Having liquid diet.	Implant stable. Having liquid diet.	Fracture site healing well.		**<u>2 months post-op:</u>** Normal feed intake. Fracture site healed wire removal done
9.	10m, M	Vehicular accident	Unilateral fracture behind 404	Implant stable. Inappetance noticed. IV fluids administered to combat dehydration.	Implant stable. Radiographs not taken. Having liquid diet.	Implant stable. Radiographs not taken. Jaw movement normal. Having soft food.	Healing noticed radiographically.	**<u>4 months post-op:</u>** Wire and acrylic removal done
10.	4years, M	Vehicular accident	Unilateral mandibular fracture behind 304.	Implant stable. Having liquid diet.	Implant stable. Shifted to liquid diet.	Fracture site healing well. Normal appetite. Good jaw movement observed.	Dog died in an accident	
11.	1year, M	Vehicular accident	Bilateral mandibular fracture caudal to 304 and between 409 and 410.	Implant stable. Having liquid diet.	Implant stable. Having liquid diet.	Fracture site healing well.	Normal feed intake. Wire and acrylic removal done. Fracture site healed.	

S. No	Age, sex	Etiology	Site of fracture	Follow up and wire removal				
				24hrs post-op	1 week post-op	20 days post-op	1-2 months post-op	Wire and Acrylic removal
12.	5years, M	Vehicular accident	Bilateral mandibular fracture behind 304 and 404 with bone loss on the left side. 305 missing.	Implant stable. Having liquid diet.	Implant stable. Shifted to liquid diet.	Fracture site healing well. Normal jaw movement observed.	Fracture site healing well. Slight malalignment seen at the left side due to bone loss.	Sufficient healing noticed. Normal feed and water intake along with normal jaw movement present. Wire and acrylic removal done.
13.	3m, F	Fell from height	Bilateral mandibular fracture, behind 304 and 404.	Implant stable. Having liquid diet.	Implant stable. Shifted to liquid diet.	The animal died in a vehicular accident.		
14.	4years, F	Dog fight	Bilateral mandibular fracture between 308 and 309; and 409 and 410 extending up to 408.	Implant stable. Having liquid diet.	Implant stable. Shifted to liquid diet.	Reduced feed intake. Slight malalignment noticed radiographically. Acrylic removed and rewiring done.	Normal feed intake and jaw movement noticed.	**3 months post-op:** Sufficient healing and callus formations noticed. Wire removal done.

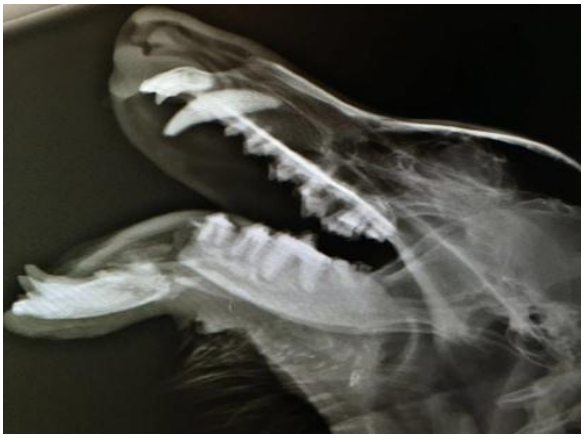

Fig. 27: Case 7- pre-operative lateral radiograph with bilateral mandible fracture behind 304 and 404 and considerable bone loss between 304 and 306

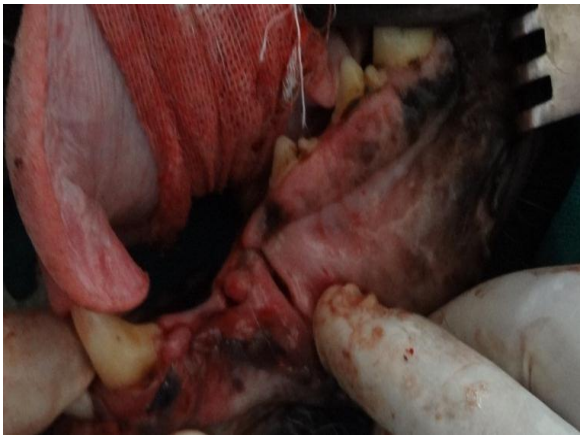

Fig. 28: Case 7- Mandible fracture (Gross appearance) - showing missing 305 and desired alignment of fragments

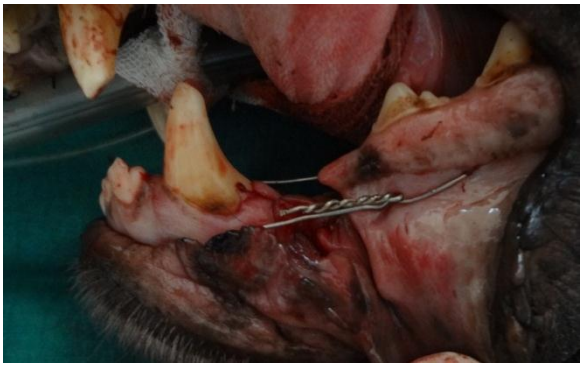

Fig. 29: Case 7- Repair of mandible fracture using orthopaedic wire. Prominent bone loss was present at the fracture site with loss of 305

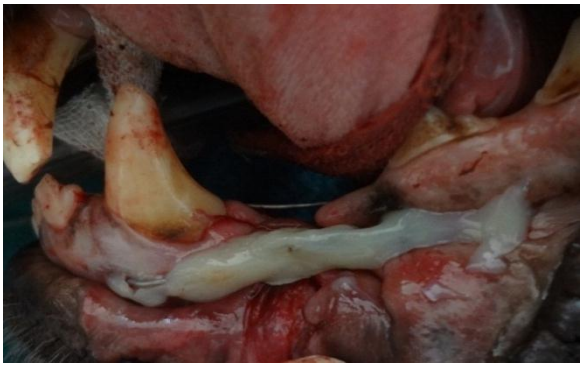

Fig. 30: Case 7- Repair of mandible fracture using acrylic. Acrylic was applied along the wire

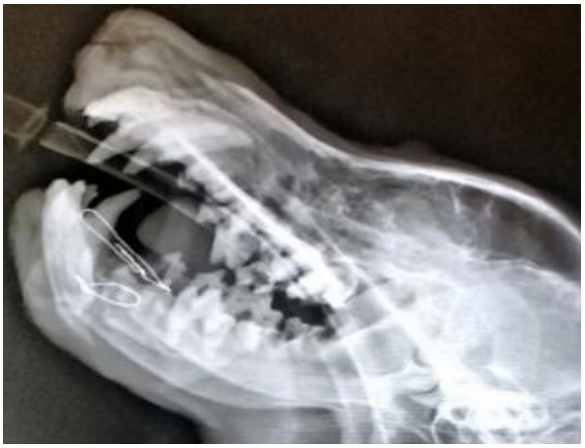

Fig. 31: Case 7- Post-operative oblique lateral radiograph showing the wiring done for the repair of the fracture site

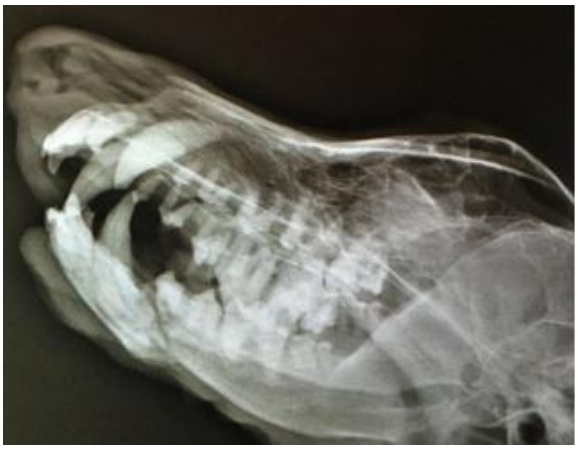

Fig. 32: Case 7- Lateral view radiograph taken post acrylic and wire removal. The fractures site healed well with sufficient bridging of the gap due to the bone loss

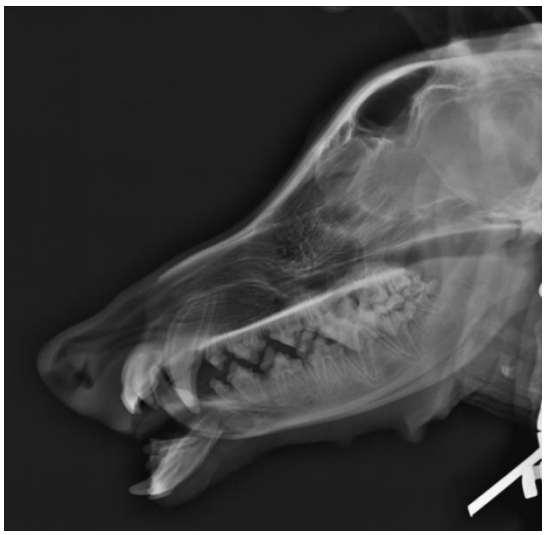

Fig. 33: Case 8- Pre-operative lateral radiograph showing bilateral fracture behind 304 and 403

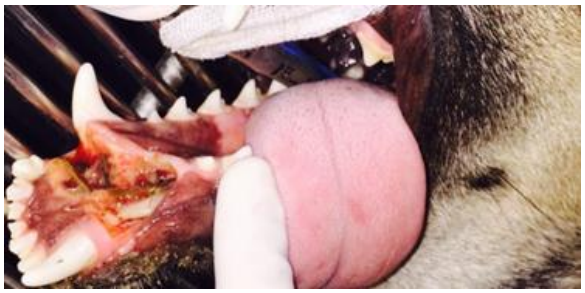

Fig. 34: Case 8- Pre-operative (Gross appearance) – showing the fractured fragments of mandible

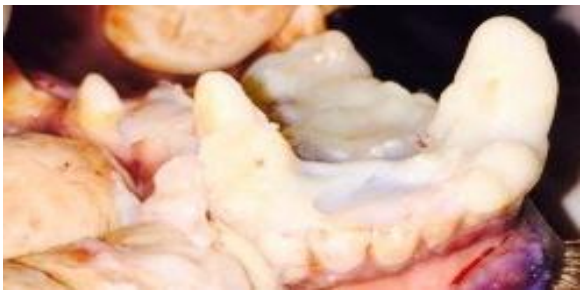

Fig. 35: Case 8- Repair of mandibular fracture using acrylic as an adjunct to orthopaedic wiring, with absence of any sharp edges

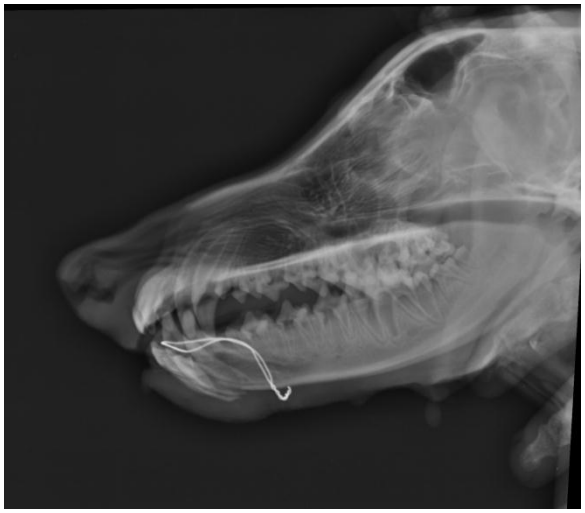

Fig. 36: Case 8- Post-operative radiograph showing the orthopaedic wiring done for repair of mandible fracture. The acrylic material cannot be appreciated radiographically.

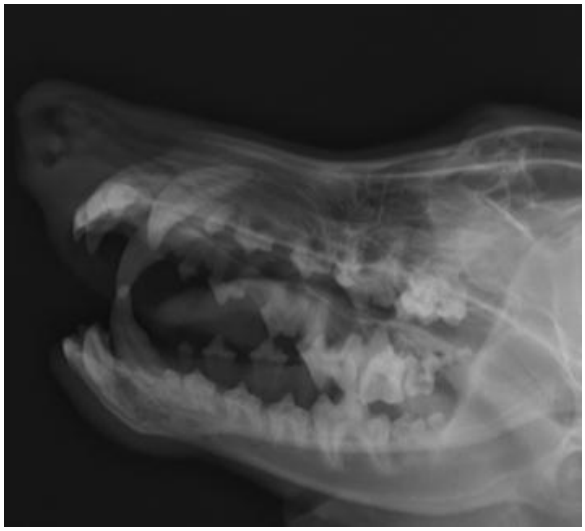

Fig. 37: Case 8- Lateral view radiograph taken post acrylic and wire removal, showing the healed fracture site

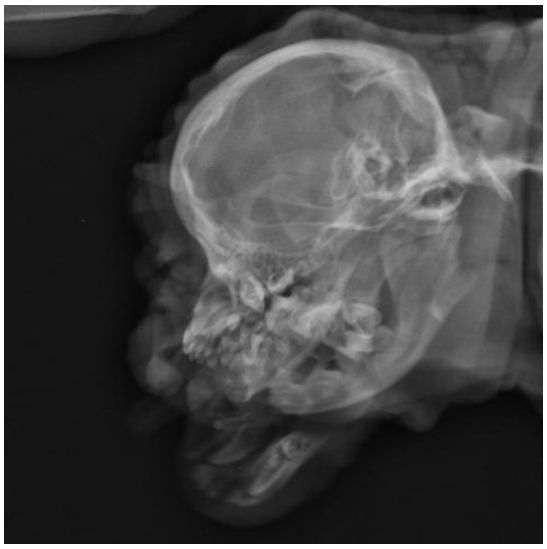

Fig. 38: Case 9- Pre-operative radiograph of bilateral mandibular fracture

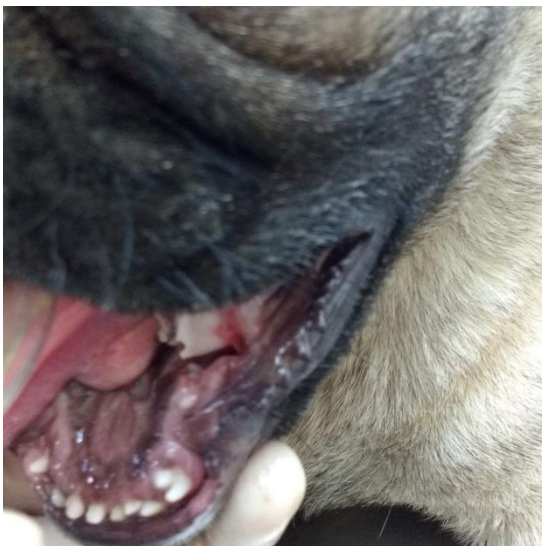

Fig. 39: Case 9- Pre-operative (Gross appearance) – showing complete fracture of the mandible

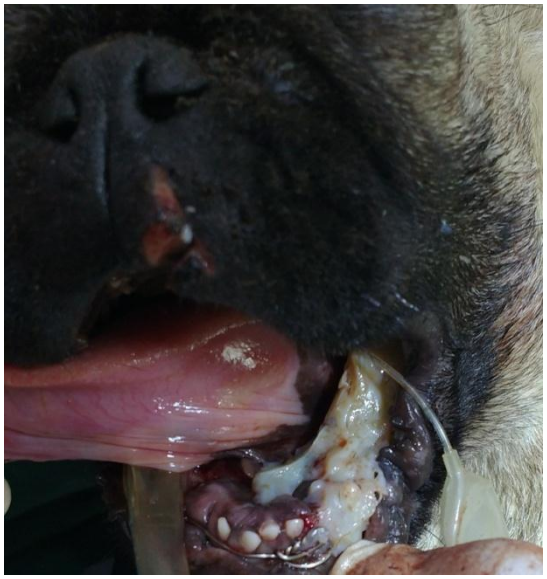

Fig. 40: Case 9- Post-operative (Gross appearance) – showing the wiring done and acrylic applied as an adjunct to the wiring

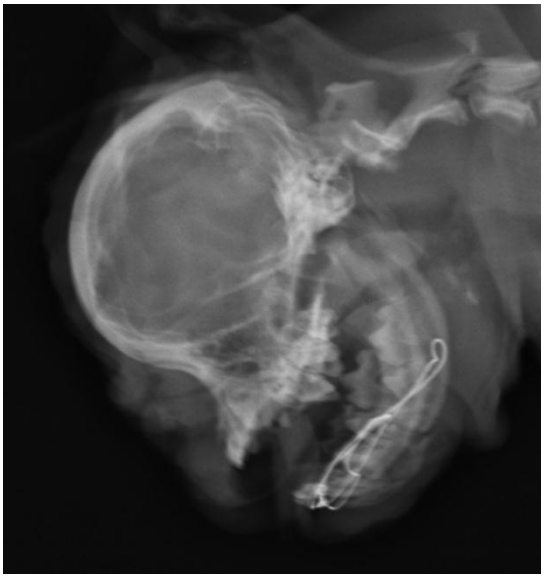

Fig. 41: Case 9- Post-operative radiograph taken in lateral view, showing the wiring done

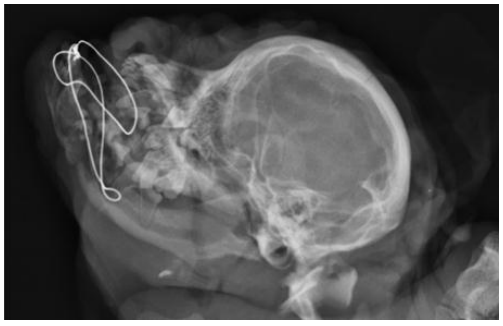

Fig. 42: Case 9- Radiograph taken in lateral view showing loosening of wire (complication)

4.6 Group III (Epidemiological Study; N=100)

Dental tartar grade distribution based on age and sex of 100 dogs included in the study was recorded (table 16). It was found that grade 1 tartar was more common in dogs between 4-8 years of age (33.33%) while grade 3 tartar was common in dogs between the ages of 8-13 years (48.57%). This was in agreement with the studies conducted by Lindhe *et al* (1975), Harvey *et al* (1994), Sorensen *et al* (2006) and Kortegaard *et al* (2008), which stated that prevalence of dental tartar increased with age.

In our study, it was also deduced that males (62%) were more affected with dental tartar than females. Similarly Sisodiya (2005) also reported 58.82 % male with 68.62% cases above 6 year age affected with dental problems. Radice *et al* (2006) conducted a study in which they reported 84.6% males with 53.8% dogs between 5-10 years of age. This was in contradiction to the studies conducted by Carreira *et al* (2015) who concluded that no gender based differences existed in prevalence of PD.

Table 16: Grade wise distribution of dogs based on age and gender-

Grade	Age (Years)			Gender	
	1-4(N=23)	4-8 (N= 42)	8-13 (N= 35)	M (N= 62)	F (N= 38)
0	39.13%	09.53%	0%	12.90%	13.16%
1	47.82%	33.33%	20%	37.10%	23.68%
2	13.05%	28.57%	31.43%	24.19%	28.95%
3	0%	28.57%	48.57%	25.81%	34.21%

Tartar distribution in dogs with and without dental homecare and previous scaling was recorded (table 17). It was concluded that dogs with no dental home care (69%) are more prone to dental tartar. The results of a study conducted by Gorrel and Bierer (1999) support that the feeding of the dental hygiene chew six days per week reduced accumulation of dental deposits, helped to maintain periodontal health, and increased the time interval between professional periodontal interventions. Emily and Penman (1990) mentioned that chewing of bone produced large quantity of saliva, which had antiseptic action and helped in prevention of plaque and dental calculus formation.

The present study is in agreement with the study done by Marshall *et al* (2014) which highlights that with no oral care regime, the early stages of periodontitis develop rapidly in Miniature Schnauzers. It also states that an oral care regime and twice yearly veterinary dental health checks should be provided from an early age for miniature schnauzers and other breeds with similar periodontitis incidence rates.

Another study by Harvey *et al* (2015) concluded that brushing more frequently had greater effectiveness in retarding accumulation of plaque and calculus, and reducing the severity of pre-existing gingivitis. This was found to be in agreement with Lindhe *et al* (1975) who found teeth brushing to be the most effective method of preventing periodontal disease in dogs. In another study, Tromp *et al* (1986) stated that brushing was only effective when performed at least 3 times a week.

The present results are in agreement with these previous studies conducted that a regular oral care regime and dental check-ups and scaling have better effects in postponing the plaque and calculus accumulation. This is in agreement with the study conducted by Logan *et al* (2002) which states that client education is an integral part of canine oral health and appropriate homecare recommendations that address the degree of oral pathology present and the ability of the client to provide frequent oral hygiene are critical to reduce plaque accumulation and gingival inflammation.

Table 17: Grade wise distribution of dogs based on dental home care and previous scaling history-

Grade	Dental Home Care (Brushing, Chewsticks And Bones)		Previous Scaling History	
	Given (N= 31)	Not Given (N= 69)	Scaling Done (N=10)	Not Done (N=90)
0	29.04%	5.80%	0%	14.44%
1	54.84%	21.74%	10%	34.44%
2	9.69%	33.33%	30%	25.56%
3	6.45%	39.13%	60%	25.56%

The incidence of tartar in different breeds of dogs (table 18) showed that the most commonly affected breed for tartar is Labrador (25%), followed by Pomeranian (13%) and Pugs and Indian breeds (10% each). While Sisodiya (2005) reported

Pomeranian was most commonly affected breed followed by German shepherd and Labrador. Harvey *et al* (1994) stated that the incidence of periodontal disease was higher in small or toy breeds.

Table 18: Grade wise distribution of dogs based on breeds-

Breeds	Grade			
	0 (N=13)	1 (N=32)	2 (N= 26)	3 (N= 29)
Pug	15.39%	15.64%	3.85%	6.90%
Golden Retriever	23.08%	9.37%	0%	3.45%
Pomeranion	15.39%	6.25%	15.38%	17.24%
St Bernard	0%	3.12%	0%	3.45%
Beagle	7.69%	3.12%	0%	6.90%
Dachshund	0%	0%	0%	3.45%
Cocker Spaniel	0%	6.25%	0%	6.90%
Labrador	7.69%	21.88%	38.46%	24.13%
Indian	0%	15.64%	15.38%	3.45%
Siberian Husky	7.69%	0%	3.85%	0%
Bulldog	7.69%	0%	0%	3.45%
Great Dane	0%	3.12%	0%	3.45%
Doberman	0%	6.25%	0%	0%
German Shepherd	0%	3.12%	7.69%	10.33%
Rottweiler	0%	0%	3.85%	0%
Lhasa Apso	7.69%	0%	7.69%	0%
Shih Tzu	0%	3.12%	0%	3.45%
Boxer	0%	3.12%	0%	0%
Dalmatian	0%	0%	0%	3.45%
Pitbull	7.69%	0%	0%	0%
Greyhound	0%	0%	3.85%	0%

The incidence of dental tartar based on the dietary history of the dogs included in the study was noted (table 19). According to the present study, a mixed diet and a dry commercial diet showed better results than a pure veg diet and soft food. Colmery

and Frost (1986) reported that dogs fed on soft diets had significantly more calculus formation and gingival inflammation than the hard diet-fed dogs. Lage *et al* (1990) stated that the current recommendations for reducing the incidence of periodontal disease in dogs include the feeding of hard rather than soft diets, and the provision of chewing material such as bones or rawhide strips. Kumar (2006) reported that in his study, 79.34% dogs were maintained on vegetarian diet and 20.65% were maintained on mixed diet out of total dogs affected with different dental affection. Patil (2004) conducted a study on 50 cases of different dental affections and reported that 48% were maintained on pure vegetarian diet and rest 52% were maintained on mixed type of food.

Table 19: Grade wise distribution of dogs based on dietary history-

Grade	Dietary History			
	Home Food- Veg (N= 16)	Home Food- Non Veg (N= 13)	Commercial Food (N= 51)	Mixed Diet (N= 20)
0	6.25%	7.69%	19.61%	25%
1	31.25%	30.77%	33.33%	30%
2	25%	30.77%	25.49%	35%
3	37.5%	30.77%	21.57%	10%

CHAPTER V

SUMMARY AND CONCLUSIONS

The present study was conducted on 45 cases of dogs with age in the range from 3 months to 13 years and weighing from 3.2 to 68 kg that were presented with dental and mandibular affections, at the veterinary clinics, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana during period from December 2014 to May 2016. Based on the affection, cases were (N=45) grouped into 2 groups, dental tartar (Group I; N=26), fractures of mandible (Group II; N=19) and were discussed individually. These groups were further subdivided based on the procedure performed, viz Group IA (dental scaling and tooth extraction), Group IB (dental scaling), Group IIA (orthopaedic wiring), Group IIB (orthopaedic wiring and acrylic).

An epidemiological study was done on 100 cases of dogs all above 1 year of age and presented with minor conditions like wound management, ear affections, bandaging, small tumours, etc to find the prevalence of dental tartar in dogs in Punjab.

In the dogs diagnosed for Dental Tartar the clinical signs ranged from tartar deposition, plaque and calculus accumulation, halitosis, reduced feed intake, furcation exposure index, gingivitis, gingival recession, abnormal salivation, oral hemorrhage, missing teeth and mobile teeth. The fourteen male (53.85%) and twelve female (46.15%) dogs included in this group had an average age of 7.54±0.51 year (1-13 years) and mean body weight 23.11±2.71 kg (3.2-68 kg). Labrador was found to be the most commonly affected breed, followed by Pomeranian and Germen Shepherd respectively. Diet history of dogs reveals that dogs fed soft food had significantly more calculus formation and gingival inflammation than the dogs fed mixed or dry food.

Out of the 26 cases presented with dental tartar, dental scaling along with tooth extraction was performed in 17 (65.38%) cases. Multi rooted teeth with furcation exposure of more than 3 and mobile teeth were extracted.

Dental scaling without tooth extractions was performed on 9 (34.62%) cases. The cases presented showed furcation exposure index of 2 or less, with no mobile teeth or root exposure. Ultrasonic scaling followed by tooth polishing was performed on these cases.

Microbiological evaluation of swab collected from super gingival dental area of all the cases revealed that staphylococcus (42.30%) was the most prevalent bacteria. Antimicrobial drug sensitivity test revealed that Clindamycin and Amoxicillin had highest in vitro susceptibility followed by the Ofloxacin. Owners were advised to feed dry food and chew sticks regularly, use chlorhexidine mouth wash and brush the teeth regularly. Follow up for 3-5 months revealed no reoccurrence of halitosis and dental tartar.

In the dogs presented with mandible fractures, the predominant clinical signs included anorexia, crepitation and mobility on manipulation, drooling of saliva, bleeding form mouth, dropping jaw, asymmetry of jaw, protrusion of tongue, and reluctance to eat. Out of the 19 mandible fracture cases presented, fourteen were males (73.68%) and five were females (26.32%). The mean age was 1.95±0.46 years (ranging from 3 months to 7 years) and mean body weight was 10.94±1.42 kg (ranging from 3.4 to 23.5 kg) with varying clinical signs. In the present study, 57.9 % dogs presented with mandible fracture were under 1 year age. Out of the 19 dogs presented, 13(68.42%) had bilateral fractures (26 mandibular fractures), 1 (5.26%) had a bilateral canine fracture as well as a symphyseal fracture and remaining 5 (26.32%) had unilateral fractures. Indian breed (73.68%) was most commonly affected, followed by Pug (15.79%). The causes of mandibular fractures recorded were trauma due to automobile accident (57.89%), dog bite (21.05%) and fall from height (15.79%), while one dog (5.26%) was kicked by a cow leading to mandibular fracture. On the basis of site of fracture, mandible fractures were divided into six anatomical regions as Symphyseal region, Canine region, Premolar region, Molar region, Ramus region and Condylar region. Most common site of fracture was canine region (61.76%) followed by premolar region (17.66%). In our study 100 % fractures were open type.

Out of the cases presented with mandible fracture, 5 (26.32%) were surgically treated by performing orthopaedic wiring. The remaining 14 cases (73.68%) were surgically treated by using acrylic as temporization material after performing orthopaedic wiring.

The epidemiological study was done on 100 cases with no presenting dental complaints. It was found that grade 1 tartar was more common in dogs between 4-8

years of age (33.33%) while grade 3 tartar was common in dogs between the ages of 8-13 years (48.57%). Males (62%) were more affected with dental tartar than females. Dogs with no dental home care (69%) were more prone to dental tartar. The most commonly affected breed for tartar was Labrador (25%), followed by Pomeranian (13%) and Pugs and Indian breeds (10% each). A mixed diet and a dry commercial diet showed better results than a pure veg diet and soft food.

CONCLUSIONS

- Dental tartar in dogs was usually seen in middle age to older age dogs fed on predominantly vegetarian and soft diet and was more common in males than in females with Labradors having most predispositions to it.
- Vehicular accidents were found to be the most common reasons for mandible fractures with canine tooth region being the most common site for mandibular fracture.
- Orthopedic wiring followed with acrylic was found successful in the repair of mandible fracture in dogs.
- Symphyseal fractures were better treated and stabilized with orthopaedic wiring than acrylic.

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VITA

Name of the student	:	Jasleen Kaur
Father's name	:	Dr. Khushwant Singh
Mother's name	:	Dr. Sanjeet Kaur
Nationality	:	Indian
Date of birth	:	17th September, 1990
Permanent home address	:	B-6, Stone Valley Apartment Banjara Hills, Road No. 4, Hyderabad – 500034, Telangana

EDUCATIONAL QUALIFICATION

Bachelor's degree	:	B.V. Sc. & A. H.
University	:	Sri Venkateshwara Veterinary University, Tirupati
Year of award	:	2013
OGPA/OCPA/% marks	:	7.16/10.00
Master's degree	:	M.V.Sc.
OGPA/OCPA/% marks	:	7.98/10.00