International Journal of Veterinary Sciences and Animal Husbandry

ISSN: 2456-2912
NAAS Rating: 4.61
VET 2025; 10(6): 261-265

www.veterinarypaper.com
Received: 19-04-2025
Accepted: 26-05-2025

Shubhangi Yelmule
M.V.Sc., Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Milind Thorat
Professor and Head, Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Ratnakar Raulkar
Associate Professors, Department of Surgery and Radiology, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Farheen Fani
Associate Professors, Department of Surgery and Radiology, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Abinav Sontakke
M.V.Sc., Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Sanket Chavan
M.V.Sc., Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Meenu PM
M.V.Sc., Scholars, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Corresponding Author:
Ratnakar Raulkar
Associate Professors, Department of Surgery and Radiology, Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola, Maharashtra, India

Surgico-therapeutic management of mandibular fractures in dog

Shubhangi Yelmule, Milind Thorat, Ratnakar Raulkar, Farheen Fani, Abinav Sontakke, Sanket Chavan and Meenu PM

DOI: https://www.doi.org/10.22271/veterinary.2025.v10.i6d.2337

Abstract
The research work was conducted to compare the efficacy of orthopaedic wiring with and without acrylic application in the surgical treatment of mandibular fractures. Eight dogs under group I were treated with orthopaedic wiring only and eight dogs under group II were treated with orthopaedic wiring with acrylic application. All dog underwent physiological, haematological, biochemical and radiographic examination at different intervals and assessed for fracture healing. Radiographic union score of 10 achieved in 12 cases indicates complete healing by two months. The mean values of time for bone healing in group I and group II were 2.2 months ± 0.06 and 1.95 months ± 0.04, respectively. Addition of acrylic provided better structural support, resulting in a higher success rate, enhanced healing and fewer complications. Orthopaedic wiring with acrylic application was found to be superior treatment choice for mandibular fractures in dogs compared to orthopaedic wiring only.

Keywords: Mandibular fracture, orthopedic wiring, acrylic application, dog

Introduction

Dog has been a cohort animal for humans since centuries and this relationship between humans and dogs keeps on growing stronger and stronger along with increased people's interest towards the care of animals. Dogs have been used not only as guard but also to help in daily routines and especially as companion animals (Iqbal, 2021) [7].

Mandible in dog forms skeleton of lower jaw and comprises of a body and two rami. The two halves of this bone fuses incompletely at the mandibular symphysis, situated at the midline within the body. The mandible is prone to trauma due to automobile accidents, fall from height or dog fights, especially in young dogs. Mandibular fractures may occur spontaneously, due to bone loss secondary to severe periodontal or endodontic infections. Treatment for mandibular fracture repair can be characterized as invasive, involving external or internal fixation devices (such as plates, external fixators, pins, and interfragmentary wires). By contrast, non-invasive treatments rely on closed reduction and tooth-borne devices (such as acrylic composite, interdental wiring, maxillomandibular rigid fixation). Non-invasive interdental splinting techniques preserve periosteal attachment and vascularization at the fracture site and minimize further dental and periodontal trauma compared to invasive treatments (Guzu *et al.,* 2016) [6].

Many techniques are available for managing maxilla-mandibular fractures including plates and screws, specialized mini plates, interdental wires, intraoral splints, acrylic splints, external fixators, intramedullary pins, inter-fragmental or intra-osseous wires, inter-arcade wiring, epoxy resin and polymethyl methacrylate (PMMA), external fixation, dental composite application, tape muzzles and combinations of these methods. Each of these techniques has its advantages and disadvantages and complications are more likely if stable and rigid immobilization is not achieved (Umphlet and Johnson, 1990) [12].

When selecting a repair technique, it is important to consider that placing fixation on the tension side of the bone will maximize the strength of the implant. For the mandible, the tension surface is the alveolar side of the bone. However, placing implants here can risk damaging tooth roots and neurovascular structures so implants are often positioned on a compressive surface which can create a mechanical disadvantage.

The most common repair methods involve various wiring techniques. Surgical wire can be applied in a hemicerclage fashion between fracture fragments or cerclage techniques can be employed especially in mandibular symphysis fractures. Additionally, the wire can be wrapped around teeth adjacent to the fracture to provide stability. Interdental wiring is a straightforward and effective procedure (Umphlet and Johnson, 1990) [12].

Dental bonding or intraoral splints have become popular among veterinary dentists as a non-invasive method for stabilizing certain fractures. Intraoral splints typically rely on the presence of intact teeth on either side of the fracture site and are most effective for mandibular fractures particularly those located rostral to the molars (Niemiec, 2003) [11]. Considering advantages and disadvantages having with the various techniques of mandibular fracture repair, the present study compares the efficacy of orthopedic wiring with and without acrylic application in the surgical treatment of mandibular fractures.

Materials and Methods

A total of 37 cases with oral affections were screened at Veterinary Clinical Complex, Post Graduate Institute of Veterinary and Animal Sciences, Akola during the study period. Out of which 16 dogs with mandibular fractures were included in this study irrespective of age, breed, sex and body weight. These clinical cases were divided into two equal groups comprising eight dogs each which were subjected to two different surgical approaches as mentioned in the table I.

Table 1: Grouping of dogs subjected to two different surgical approaches

Groups Mandibular fracture (N= 16)	Surgical Approach
Group I (N=8)	Orthopaedic wiring
Group II (N=8)	Orthopaedic wiring with acrylic application

The physiological parameters *viz*, rectal temperature (°F), heart rate (beats/min.) and respiratory rate (breaths/min.) were recorded on the day '0' pre-operative as well as post-operative and 7th, 14th, 30th and 60th post-operative day.

Six anatomical regions were used to classify the mandibular fracture location. These regions were as follows: Symphyseal, Canine region, Premolar region, Molar region, ramus region and condylar region (Umphlet and Johnson, 1990) [12]. Mandible fractures were fixed surgically either by orthopaedic wiring or by wiring along with acrylic (Protemp™ 4) application as a composite material for the fabrication of temporary restorations.

All dogs were premedicated with Inj. Atropine sulphate @ 0.02mg/kg subcutaneously, then sedated with the combination of Inj. Xylazine @ 1 mg/kg + Inj. Butorphanol @ 0.2 mg/kg intramuscularly. Anaesthetic induction was performed using a combination of Inj. Midazolam @ 0.2 mg/kg and Inj. Propofol @ 4mg/kg intravenously. Anaesthesia was maintained with isoflurane @ 2% in combination with 100% oxygen. Orthopaedic wiring in Group I was carried out by drilling holes approximately 5mm rostral and caudal to the fracture site, between the roots of the multirooted tooth and then passing the orthopaedic wire through the hole. A hand-held drill with 1.7 mm / 2.5mm size bit was used to drill the holes. Orthopaedic wiring was done as a staple suture or 8-shaped patterns for different sites of the fracture. In Group II, along with orthopaedic wiring, acrylic was applied as an adjunct for sufficient anchorage. Teeth and metallic surfaces like orthopaedic wire were used as anchorage for acrylic. 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 moulded with gloved 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. Immediately after surgery, skull radiographs (Lateral and Dorso-ventral view) were taken to assess the anatomical reduction of fracture fragments.

The haematological parameters such as Haemoglobin (g/dL), Total Leucocyte Count (N × 10^3 /cu.mm) Differential Leucocyte Count (%) were analysed on day '0' pre-operative and on 7th, 14th, 30th and 60th post-operative day. Biochemical examination such as Blood Urea Nitrogen (mg/dl), Serum creatinine (mg/dl), Alkaline phosphatase (IU/L), Aspartate aminotransferase (IU/L), Alanine aminotransferase (IU/L), Calcium (mg/dl), Phosphorus (mg/dl) and Total Protein (g/dl) were evaluated on day 0th, 7th, 14th, 30th and 60th post-operative day. Radiographic assessments were conducted preoperatively and immediately after surgery to evaluate fracture reduction and at subsequent intervals (14th day, 30th day and 60th day) to monitor the progress of fracture healing (Figure 1-5).

Results and Discussion

The incidence of mandibular fractures in dogs were highest due to dog fight (56.25%), followed by automobile accidents (25%), fall from height (12.50%), and the lowest incidence was occured due to direct hit (6.25%). These findings are in accordance with Lopes *et al.* (2005) [10] who noted that the most common cause of fracture was dog fight (43.0%) followed by automobile trauma (12.0%). The highest incidence of mandibular fractures in the premolar (33.33%) and symphyseal (23.81%), followed by canine region (23.81%), molar region (19.05%), in ramus and condylar regions no fractures observed. The findings are corroborated with the findings of Glyde and Lidbetter (2003) [5] who recorded maximum number of fractures in the mandibular body, most frequently in the premolar region. They opined that it might be due premolar/molar part of the mandible that exposed to traumatic insults, especially those occurring from the side or the bottom direction and it may also be contributed to the presence of a weak site of the immature mandibular symphysis which acts as a predisposing factor for fracture. The incidence of mandibular fractures in dogs was highest in those under one year old (87.50%), followed by the dogs aged 1-2 years with no cases reported in dogs over two years. These findings are aligned with the study of Umphlet and Johnson (1990) and Kitshoff *et al.* (2013) [12, 9] who reported a significantly higher occurrence of mandibular fractures in dogs under one year old. Moreover, they opined that bone mineral content and bone mineral density in younger dogs were found to be lower than older dogs which tend to have maximum mandibular fracture incidences in younger than in older dogs. The highest incidence of mandibular fractures in dogs was observed in Mongrel dogs (81.25%) followed by Golden Retriever, Labrador, and German shepherd (6.25%) each. It is attributed to the high population density of mongrel dogs in and around the Akola city where the study was undertaken. The incidence of mandibular fracture in dogs was found to be higher in males (68.75%) compared to females (31.25%). These findings unison with the studies of Umphlet and Johnson (1990) and Kitshoff *et al.* (2013) [12, 9] who also reported a higher incidence of mandibular fractures in male dogs than in females. This may be attributed to the relatively aggressive nature and roaming behaviour of male dogs, making them more susceptible to fractures. In the present study, clinical signs exhibited by dogs varied from anorexia, crepitation, jaw mobility upon manipulation, excessive drooling of saliva, oral bleeding, jaw dropping, jaw asymmetry, tongue protrusion and reluctance to eat. Haematological parameters such as Haemoglobin (g/dL), Total Leucocyte Count (x 10^3/cu.mm) and Differential Leucocyte Count (%) were estimated for both the groups at different intervals. The variations in the values were non-significant but remained within normal physiological limits. Biochemical parameters such as Blood Urea Nitrogen, Creatinine, Aspartate amino transferases, Alanine amino transferases, and total protein showed non-significant changes, with values fluctuating within normal physiological limits. However, Calcium and Alkaline phosphatase levels were initially low, peaked on the 14th and 30th postoperative days, and then declined by the 60th day. Phosphorus values significantly elevated and peaked on 7^{th} postoperative day then followed a declining trend at subsequent intervals (illustrated in table II). These findings are in agreement with the results reported by Boorman *et al.* (2020), Ghadban and Khashjoori (2022), and Amal (2023) [3, 4, 1] who also observed that calcium levels were initially normal, followed by a significant increase between the 14^{th} and 30^{th} postoperative days, and then returned to normal by the 60^{th} day. They preached that this increase might be due to the deposition of excess calcium at the fracture site during the healing process. The rise in calcium levels on the 14^{th} and 30^{th} postoperative days was attributed to the fracture healing entering the remodelling phase. Radiographic union score (described by Al-Sobayil *et al.*, 2020) [2] was assessed on ‘0’, 14^{th}, 30^{th} and 60^{th} postoperative day, for all the dogs on the basis of fracture line visibility, presence or absence of callus, fracture healing. In group I, the radiographic union score was 10 in six cases, indicating complete fracture healing by the 60^{th} postoperative day except two cases. In group II, the radiographic union score was 10 in seven cases, indicating that the fractures had completely healed by the 60^{th} postoperative day except one case.

Table 2: Haemato-Biochemical parameters of dogs under both the groups at different intervals

Para meter		Day 0	Day 7	Day 14	Day 30	Day 60
Hb	Gr 1	11.31±0.41	11.39±0.37	11.33±0.32	11.36±0.31	11.36±0.23
	Gr 2	11.31±0.38	11.33±0.4	11.38±0.32	11.34±0.3	11.35±0.19
TLC	Gr 1	15.41±0.39	15.33±0.36	15.25±0.32	15.2±0.31	15.24±0.34
	Gr 2	15.78±0.22	15.53±0.25	15.44±0.29	15.33±0.39	15.56±0.45
Neutro phils	Gr 1	69.88±1.23	70.38±2.3	70.75±2.2	70.38±1.35	71.25±0.73
	Gr 2	69.75±1.93	71.5±1.93	71±1.15	71.63±0.68	70.63±1.07
Lympho cytes	Gr 1	22.75±1.35	21.88±1.53	22±1.56	22±0.63	21.63±0.38
	Gr 2	23.63±1.13	21.88±1.27	21.75±1.35	22.13±1.29	22.63±0.96
Calcium	Gr 1	9.84±0.44	12.83±0.47	15.77±0.51	16.43±0.51	12.38±0.92
	Gr 2	9.92±0.5	12.95±0.48	15.84±0.3	16.29±0.31	12.13±0.31
Phosphorus	Gr 1	6.9±0.18	11.41±0.7	6.28±0.41	6.24±0.53	5.93±0.38
	Gr 2	7.04±0.4	11.58±0.36	7.24±0.31	6.85±0.43	6.48±0.36
ALP	Gr 1	93.38±1.35	98.38±0.42	98.75±0.31	96.25±0.53	91.19±4.26
	Gr 2	92.13±2.29	97.38±1.19	98.38±0.92	97.63±2.93	91.5±2.62
AST	Gr 1	46.46±1.96	46.41±1.04	46.9±1.75	47.35±2.37	47.53±1.56
	Gr 2	46.47±2.92	46.55±3.13	47.51±2.33	46.68±2.07	47.48±1.83
ALT	Gr 1	64.11±6.14	64.26±5.94	64.44±4.81	64.39±5.1	64.29±4.63
	Gr 2	64.64±3.07	64.9±2.54	64.38±3.18	64.38±4.46	64.75±3.75
Total Proteins	Gr 1	6.53±0.18	6.51±0.14	6.51±0.07	6.5±0.1	6.53±0.1
	Gr 2	6.58±0.14	6.56±0.12	6.58±0.09	6.69±0.16	6.66±0.08
BUN	Gr 1	22.13±0.52	22.25±0.45	22.13±0.48	22.63±0.63	24.82±0.12
	Gr 2	22.5±0.38	22.38±0.38	22.63±0.26	22.38±0.32	22.63±0.38
Creatinine	Gr 1	0.86±0.13	0.88±0.13	0.84±0.1	0.87±0.09	0.86±0.1
	Gr 2	0.87±0.08	0.88±0.08	0.89±0.07	0.89±0.08	0.86±0.07

Table 3: Radiographic union score of dogs of both the group

Radiographic Union Score					
	Day				Total Score
Group I	**Day 0**	**Day 14**	**Day 30**	**Day 60**	
Case 1	1	2	3	4	10
Case 2	1	2	3	4	10
Case 3	1	2	3	4	10
Case 4	1	2	3	4	10
Case 5	1	2	3	4	10
Case 6	1	2	3	4	10
Case 7	1	1	2	2	6
Case 8	1	2	2	2	7
Group II	**Day 0**	**Day 14**	**Day 30**	**Day 60**	**Total score**
Case 1	1	2	3	4	10
Case 2	1	2	3	4	10
Case 3	1	2	3	4	10
Case 4	1	2	3	4	10
Case 5	1	2	-	-	3
Case 6	1	2	3	4	10
Case 7	1	2	3	4	10
Case 8	1	2	3	4	10

Total Score 4: Fracture definitely not healed
Total Score 10: Fracture completely healed

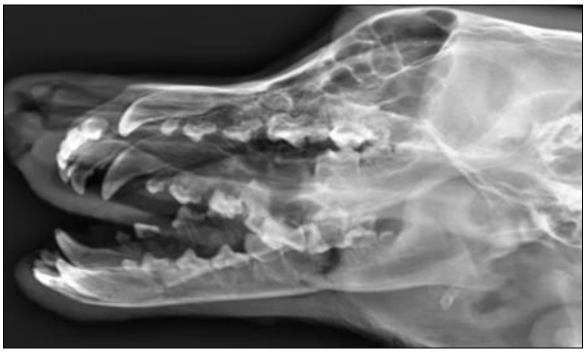

Fig 1: Lateral radiograph of dog showing bilateral complete, mandible fracture at molar region at the time of presentation

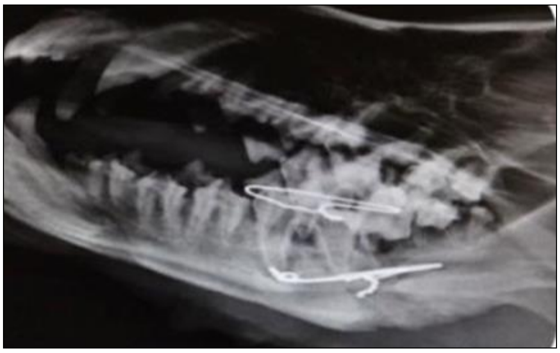

Fig 2: Lateral radiograph of dog after fracture reduction

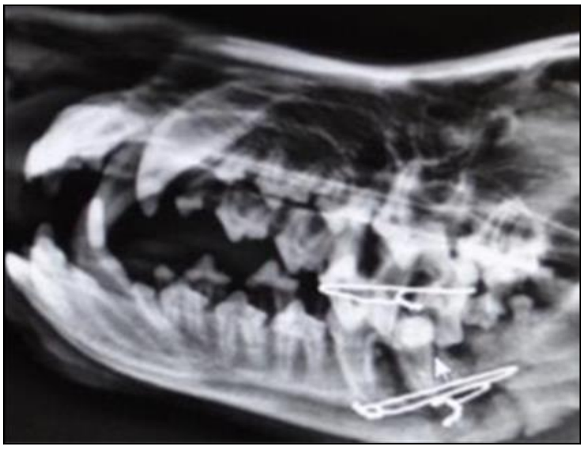

Fig 3: Dorsoventral radiograph of skull at 30th post-operative day

Fig 4: Dorsoventral radiograph of skull at 30th post-operative day

Fig 5: Lateral radiograph of skull of dog after wire removal

No complication was encountered during the intra-operative period of the study. Post-operative complications observed includes malocclusion, tooth loosening, implant loosening, infection and bone necrosis.

Time for bone healing was recorded for all dogs. The mean values for time for bone healing for Group I and Group II was 2.2 months ± 0.06 SE and 1.95 months ± 0.04 SE, respectively. The accelerated healing observed in Group II may be attributed to enhanced wire stability facilitated by acrylic bio-adhesive application.

The functional outcome in all the dogs were recorded based on clinical and radiographic healing assessment. In Group I, three dogs exhibited excellent, three had well and two had poor results. However, in Group II, four dogs showed excellent, three had well, and one had poor outcomes.

Conclusions

Dog fights are the leading cause of mandibular fractures, followed by automobile accidents. Orthopaedic wiring alone proved to be an effective method for managing mandibular fractures in dogs but associated with few complications. Orthopaedic wiring combined with acrylic application provides enhanced structural support, promotes faster healing with minimal complications, and has been proven to be an effective and superior treatment option for mandibular fractures in dog.

Conflict of interest

Not available

Financial support

Not available

References

1. Amal K. Comparative Evaluation of Stainless Steel and Titanium Dynamic Compression Plates for Management of Long Bone Fractures in Dogs [Doctoral Dissertation]. Tirupati: Sri Venkateswara Veterinary University, 2023.
2. Al-Sobayil F, Sadan MA, El-Shafaey ES, Ahmed AF. Can bone marrow aspirate improve mandibular fracture repair in camels (*Camelus dromedarius*)? J Vet Sci. 2020;21(6):90.
3. Boorman S, Lascola K, Pereira MM, Ceriotti S, Boone L. Internal fixation of a complicated mandibular fracture in a filly using a string-of-pearls locking plate assisted by a 3D Printed Model. VCOT Open. 2020;3(2):90-95.
4. Ghadban AA, Khashjoori BK. Assessment of serum alkaline phosphatase and calcium levels during bone fracture healing in dogs stabilized with a bone plate after being treated with an amniotic membrane loaded with platelet rich plasma. J Pharm Negat Results. 2022;13(6):3159-3168.
5. Glyde M, Lidbetter D. Management of fractures of the mandible in small animals. In Practice. 2003;25(10):570-585.
6. Guzu M, Hennet PR. Mandibular body fracture repair with wire-reinforced interdental composite splint in small dogs. Vet Surg. 2017;46(8):1068-1077.
7. Iqbal N, Khan MA, Luqman Z, Rashid HB, Khan MUR, Hussain N, *et al*. A biochemical study of diazepam as a pre-anesthetic in combination with various anesthetics during orchidectomy in dogs. Agrobiological Records. 2021;3:24-28.
8. Kitshoff AM, Rooster DH, Ferreira SM, Steenkamp GA. A retrospective study of 109 dogs with mandibular fractures. Vet Comp Orthop Traumatol. 2013;26(01):01-05.
9. Lopes FM, Gioso MA, Ferro DG, Leon-Roman MA, Venturini MA, Correa HL. Oral fractures in dogs of Brazil: A retrospective study. J Vet Dent. 2005;22(2):86-90.
10. Niemiec BA. Intraoral acrylic splint application. J Vet Dent. 2003;20(2):123-126.
11. Umphlet RC, Johnson AL. Mandibular fractures in the dog: A retrospective study of 157 cases. Vet Surg. 1990;19(4):272-275.

How to Cite This Article

Yelmule S, Thorat M, Raulkar R, Fani F, Sontakke A, Chavan S, *et al*. Surgico-therapeutic management of mandibular fractures in dog. International Journal of Veterinary Sciences and Animal Husbandry. 2025;10(6):261-265.