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RESEARCH ARTICLE

Short-Term Outcomes of Closed Butterfly-Shaped External Fixation in Feline and Canine Carpal and Tarsal Joint Instability

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Abstract

The aim of this study was to evaluate the short-term clinical and radiographic outcomes of a butterfly-shaped external fixation technique applied using a closed approach for the stabilization of traumatic carpal and tarsal joint instability in cats and dogs. This study included 39 patients (29 cats and 10 dogs) presented with acute lameness to the Surgical Clinic of Istanbul University–Cerrahpaşa Faculty of Veterinary Medicine. Clinical and radiographic examinations revealed carpal or tarsal joint instability associated with luxation and ligament injuries. Joint stabilization was achieved without opening the joint by applying a linear type II external skeletal fixation system using Kirschner wires connected with thermoplastic material. The butterfly-shaped configuration was designed to provide temporary joint stabilization and promote periarticular fibrosis rather than osseous fusion. Postoperative clinical examinations and stress radiography were performed at the 4th and 8th postoperative weeks. Successful joint stabilization was achieved in 97% of the cases by the 8th postoperative week. Most complications were minor and included pin tract infection, skin irritation, and occasional pin breakage. External fixation materials were removed at the 12th postoperative week in the majority of patients without any adverse effects or recurrence of instability. The butterfly-shaped external fixation technique applied via a closed approach is a minimally invasive, cost-effective, and well-tolerated alternative to arthrodesis for the treatment of carpal and tarsal joint instability in cats and dogs. Temporary immobilization for 8–12 weeks was sufficient to restore joint stability with a low complication rate.

Keywords: Arthrodesis, Carpal, Cat, Dog, External fixation

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Introduction

Carpal and tarsal joint injuries in cats and dogs are primarily caused by trauma, such as jumping or falling from heights, direct trauma, and traffic accidents (Earley and Dee 1980, Vaughan 1985, Guillard 2003, Voss et al 2004). In the tarsal joint, damage to the plantar and collateral ligaments results in proximal intertarsal and tarsometatarsal luxations. In the carpal joint, instability is caused by damage to the palmar ligaments. Additionally, intra-articular fractures and metacarpal/metatarsal fractures can lead to joint damage (Dyce et al 1998, Fettig et al 2002, Haburjak et al 2003, Piermattei et al 2006).

During the clinical examination of carpal and tarsal joint instability, non-weight-bearing lameness, joint swelling, and abnormal joint movement are observed. Treatment can be either conservative or operative. In conservative treatment, casts or splints are applied for at least 4 weeks. Operative treatment involves arthrodesis or internal immobilization (Guillard 2003, Swaim et al 2015).

Arthrodesis can be performed using techniques such as intramedullary pins with tension bands, transfixed pins, lateral bone plates, and external fixation (Johnson and Houlton 2005, Vannini and Bonath 2005, Piermattei et al 2006, Shanil et al 2006). Internal immobilization techniques use crossed pins, plates, screws with tension bands, and external fixation to achieve joint fusion with periarticular fibrosis (Jaeger and Roe 2005, Beever et al 2016).

However, conventional arthrodesis techniques are associated with a considerable risk of postoperative complications, including implant failure, infection, delayed or non-union, and persistent lameness. Minor complications such as wound-related problems and limb swelling have also been reported. Moreover, these procedures require extensive joint preparation and may involve technical challenges, increasing surgical invasiveness and recovery time (Willer et al 1990, Haburjak et al 2003, Lotsikas and Radasch 2006, Roch et al 2008). These limitations highlight the need for less invasive and more cost-effective alternative stabilization techniques.

This study aimed to share the successful results of joint stabilization in cases of carpal and tarsal joint injuries in cats and dogs, using a closed approach with Kirschner pins and external fixation, and to contribute to the literature.

Material and Methods

This study was conducted on 10 dogs and 29 cats with acute lameness, brought to Surgery Department of Istanbul University- Cerrahpasa Veterinary Faculty. Clinical examination revealed carpal and tarsal joint instability along with crepitation during joint movement, severe pain, and joint swelling. Dorsopalmar and mediolateral stress radiographs were taken to identify the pathological lesions leading to carpal and tarsal instability. The cortical thickness of the carpal and tarsal joint bones was determined radiographically, and the appropriate Kirschner wire to be used in surgery was selected. Hemogram and serum biochemical tests were conducted prior to the operation. Premedication was administered via IV Medetomidine HCL, followed by induction with 4 mg/kg of Propofol 5 min later. Anesthesia was maintained with 2% isoflurane. The animals were positioned laterally with the affected limb facing upwards on the operating table. The surgical site was disinfected with chlorhexidine (hibitanol). The carpal or tarsal joint was positioned in the dorsopalmar position, and the "butterfly technique" was applied. The goal of the butterfly technique is to stabilize the joint without opening it. In this technique, various sizes of Kirschner wires are used, typically 4 pins, which are connected using thermoplastic material (X-lite). The number of pins is generally sufficient for joint stabilization but can be increased if needed. Furthermore, the stabilization of the joint is achieved through periarticular fibrosis.The application of the butterfly technique for both carpal and tarsal joints is outlined below.

Application of the Butterfly Technique to the Carpal Joint

In the dorsopalmar position, the affected carpal joint was positioned, and the first Kirschner pin was inserted horizontally through the center of the metacarpals, passing through the cortex of the second and fifth metacarpals. Next, a second pin was placed in a crossed manner, approximately 0.5 to 1 cm above the previous pin, advancing from distal to proximal. This second pin was initiated at the second metacarpal, passed through the lower row of carpal bones and the ulnar carpal bone, and exited laterally from the ulnar carpal bone. Then, a third pin was inserted in a distal-to-proximal direction, starting from the fifth metacarpal and crossing over the previous pin. Finally, a Kirschner pin was inserted horizontally through the distal metaphysis of the radius. The angle of the joint was measured using a plastic goniometer (Yıldızlar, Türkiye). Subsequently, the proximal pins were bent towards the distal side, and the distal pins were bent towards the proximal side so that they contacted each other. The bent pins were then secured to each other using a two-layer attachment with thermoplastic material (Figure 1).

Figure 1. Schematic view of carpal joint stabilization.

Application of the Butterfly Technique to the Tarsal Joint

In the dorsopalmar position, the tarsal joint was first stabilized by placing the first pin horizontally from the center of the metatarsals, directed from the second metatarsal to the fifth metatarsal. Then, a second pin was placed 0.5–1 cm above the previous pin, crossing

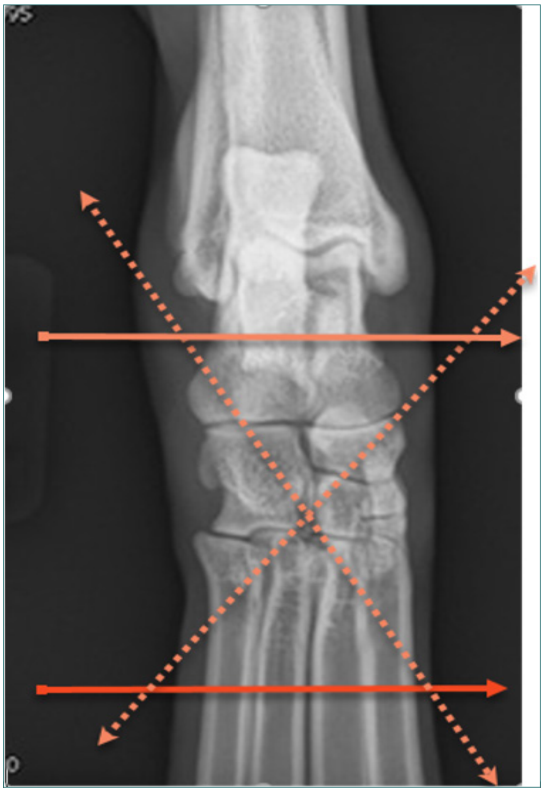

Figure 2. Schematic view of the application of the butterfly technique in tarsal joint stabilization.

from distal to proximal. This pin was passed through the second metatarsal and the lower row of tarsal bones, exiting laterally from the talus. Next, a third pin was placed starting from the fifth metatarsal, crossing from distal to proximal. This pin was passed through the fifth metatarsal and the lower row of tarsal bones, exiting laterally from the central tarsal bone. Finally, a transtalar pin was inserted through the central part of the talus. The proximal pins were bent distally, and the distal pins were bent proximally, making contact with each other. These bent pins were fixed together using a two-layer thermoplastic material (Figure 2).

For the patients, Ceftriaxone Sodium (Novosef) was prescribed at a dose of 25 mg/kg once daily for 7 days after surgery, and Butorphanol at a dose of 0.04 mg/kg three times a day for 5 days. Postoperative control X-rays were taken at the 4th and 8th weeks. The clinical outcomes of the patients were evaluated based on (Cook et al 1999) classification system, with clinical lameness scores ranging from 0 to 5 at the 8th week post-surgery. In the 10th week post-surgery, a short anesthesia (15 min) was administered, and the implant material was removed.

Ethical Approval

Ethical approval was not required for this study in accordance with Article 8(k) of the Regulation on Working Procedures and Principles of Animal Experiments Ethics Committees, as the study was based on clinical cases presented for routine diagnosis and treatment. All procedures were performed in compliance with institutional and ethical standards.

Statistical Analysis

Statistical analyses were performed using clinical and demographic data obtained from feline and canine cases. Descriptive statistics for continuous variables were expressed as median and interquartile range (IQR). Due to the lack of normal distribution and the limited sample size, non-parametric statistical tests were applied. Comparisons between cases with carpal and tarsal joint lesions were conducted using the Mann–Whitney U test. Similarly, clinical scores and time-related variables were compared between cases with and without complications using the Mann–Whitney U test. Comparisons of clinical variables among lesion types (groups with ≥3 cases) were performed using the Kruskal–Wallis test. The association between complication occurrence and animal species (cat/dog) or affected joint (carpal/tarsal) was evaluated using Fisher's exact test. Relationships between variables were assessed using Pearson and Spearman correlation analyses. Statistical significance was set at $p<0.05$.

Results

Between March 2022 and January 2024, 39 patients, including cats and dogs of various ages and breeds with carpal and tarsal joint instability detected through orthopedic examination, radiographic, and advanced imaging techniques, were evaluated at the surgery department. Among these, 23 had carpal joint lesions, and 16 had tarsal joint lesions.

In cats, the age distribution was predominantly between 1 and 5 years. Mixed-breed cats constituted the majority of cases, while British Shorthair, Scottish Fold, Siamese, and Van cats were less frequently represented. Most cats were male, and body weights were mainly within the range of 3–4 kg.

In dogs, age distribution was more heterogeneous. Both mixed-breed and purebred dogs were included, with breeds such as Golden Retriever, Labrador Retriever, Malinois, and Rottweiler represented. Male dogs were more common, and body weights ranged broadly between 12 and 40 kg. Detailed signalment data, including species, breed, age, sex, and body weight, are presented in Table 1.

Based on owner-reported history, trauma was identified as the primary cause of joint instability. In cats, falling from a height was the most common etiology, whereas in dogs, traffic accidents and limb entrapment were more frequently reported. The majority of patients were presented within 1–2 days following the traumatic event.

Clinical examination revealed crepitus, pain, and

Table 1. Signalment of cats and dogs included in the study (n = 39).					
Case No.	Species	Breed	Age	Sex	Body Weight (kg)
1	Dog	Labrador Retriever	7 years	Male	33
2	Dog	Mixed breed	3 years	Female	12
3	Cat	Mixed breed	2 years	Male	3
4	Cat	Siamese	12 months	Male	3.4
5	Cat	British Shorthair	6 months	Male	2.5
6	Cat	Scottish Fold	3 years	Female	4.5
7	Cat	Mixed breed	10 months	Male	3
8	Cat	Van Cat	3.5 years	Male	4
9	Cat	Mixed breed	Unknown	Male	3.5
10	Cat	Mixed breed	4 years	Male	3.8
11	Cat	Scottish Fold	1.5 years	Female	3
12	Dog	Mixed breed	8 years	Male	35
13	Dog	Golden Retriever	5 years	Male	40
14	Cat	Mixed breed	5 years	Female	4
15	Cat	British Shorthair	7 years	Male	6
16	Cat	Mixed breed	3 years	Male	3.2
17	Cat	Mixed breed	2 years	Female	3.6
18	Cat	Mixed breed	1 year	Male	3
19	Cat	Mixed breed	4 years	Male	4
20	Cat	Mixed breed	6 years	Female	4.8
21	Cat	Mixed breed	5 years	Male	3.9
22	Cat	Mixed breed	3 years	Female	4.2
23	Cat	Mixed breed	2 years	Male	3.1
24	Cat	Mixed breed	1 year	Male	2.9
25	Cat	Mixed breed	4 years	Female	4
26	Cat	Mixed breed	3 years	Male	3.5
27	Cat	Mixed breed	6 years	Female	4.7
28	Cat	Mixed breed	5 years	Male	4
29	Cat	Mixed breed	2 years	Male	3.3
30	Cat	Mixed breed	3 years	Female	4
31	Cat	Mixed breed	4 years	Male	3.6
32	Cat	Mixed breed	5 years	Female	4.5
33	Cat	Mixed breed	7 years	Male	5
34	Cat	Mixed breed	6 years	Female	4.8
35	Cat	Mixed breed	3 years	Male	3.7
36	Cat	Mixed breed	2 years	Female	3.4
37	Cat	Mixed breed	4 years	Male	3.9
38	Cat	Mixed breed	5 years	Female	4.6
39	Cat	Mixed breed	3 years	Male	3.5

Table 2. Lesion characteristics, affected joints, etiology, lameness scores at postoperative 8. week, and complications.					
Case No.	Affected joint	Lesion	Etiology	Lameness Score (week 8)	Complication
1	Tarsal (Right)	Tarsometatarsal luxation	Limb entrapment	1	Skin redness
2	Tarsal (Left)	Tarsometatarsal luxation	Jumping from height	0	None
3	Tarsal (Left)	Tarsometatarsal luxation	Fall from height	1	None
4	Tarsal (Right)	Tarsometatarsal luxation	Fall from height	0	None
5	Tarsal (Left)	Tarsometatarsal luxation	Fall from height	2	Pin tract infection
6	Carpal (Right)	Intercarpal luxation	Trauma	1	None
7	Carpal (Left)	Intercarpal luxation	Fall from height	0	None
8	Tarsal (Right)	Tarsometatarsal luxation	Trauma	1	None
9	Carpal (Left)	Carpometacarpal luxation	Unknown	0	None
10	Carpal (Right)	Intercarpal luxation	Trauma	1	None
11	Carpal (Left)	Intercarpal luxation	Trauma	0	None
12	Carpal (Right)	Intercarpal instability	Trauma	2	Joint swelling
13	Carpal (Left)	Carpometacarpal luxation	Trauma	1	None
14	Tarsal (Right)	Tarsometatarsal luxation	Fall from height	0	None
15	Carpal (Right)	Antebrachiocarpal luxation	Trauma	2	Pin breakage
16	Carpal (Left)	Intercarpal luxation	Trauma	0	None
17	Tarsal (Right)	Tarsometatarsal luxation	Fall from height	1	None
18	Carpal (Left)	Radial carpal bone subluxation	Trauma	0	None
19	Carpal (Right)	Intercarpal luxation	Trauma	1	None
20	Tarsal (Left)	Tarsometatarsal luxation	Trauma	0	None
21	Carpal (Right)	Intercarpal luxation	Fall from height	1	None
22	Tarsal (Right)	Tarsometatarsal luxation	Trauma	0	None
23	Carpal (Left)	Carpometacarpal luxation	Trauma	1	None
24	Carpal (Right)	Intercarpal luxation	Fall from height	0	None
25	Tarsal (Left)	Tarsometatarsal luxation	Trauma	1	None
26	Carpal (Left)	Intercarpal luxation	Trauma	0	None
27	Tarsal (Right)	Calcaneoquartal luxation	Trauma	1	None
28	Carpal (Right)	Intercarpal luxation	Fall from height	0	None
29	Carpal (Left)	Carpometacarpal luxation	Trauma	1	None
30	Tarsal (Left)	Tarsometatarsal luxation	Trauma	0	None
31	Carpal (Right)	Intercarpal luxation	Trauma	1	None
32	Tarsal (Right)	Tarsometatarsal luxation	Trauma	0	None
33	Carpal (Left)	Intercarpal luxation	Trauma	1	None
34	Tarsal (Left)	Tarsometatarsal luxation	Trauma	0	None
35	Carpal (Right)	Carpometacarpal luxation	Trauma	2	Metacarpal swelling
36	Tarsal (Right)	Tarsometatarsal luxation	Trauma	0	None
37	Carpal (Left)	Intercarpal luxation	Trauma	1	None
38	Tarsal (Left)	Tarsometatarsal luxation	Trauma	0	None
39	Carpal (Right)	Intercarpal luxation	Trauma	1	None

periarticular swelling in all cases. In cats, lesions were more frequently localized to the carpal region, whereas in dogs, carpal and tarsal involvement was more evenly distributed.

For those with crepitus and non-weight-bearing limbs, two radiographic views (antero-posterior and medio-lateral) of the affected limbs were obtained. In cats, intercarpal and antebrachiocarpal luxations were the most frequently observed lesions, while tarsometatarsal luxations predominated in the tarsal region. In dogs, both carpal and tarsal joint instabilities were identified, with tarsometatarsal and intercarpal instabilities being the most common.

A linear type 2 external fixation system with butterfly-type external fixators was used on the patients. Four pins were used for joint stabilization in all cases. The postoperative clinical appearance of the external fixation construct is presented in Figure 3, demonstrating the configuration and positioning of the fixation system applied for joint stabilization The pin diameters for cats were 1, 1.2, and 1.4 mm, while for dogs, they ranged from 1.4 to 2.5 mm.

Figure 3. Postoperative clinical appearance of the external fixation construct in Case 14 with right tarsometatarsal luxation.

Postoperative Complications

After the surgery, 2 cats developed pin site infections, 3 had skin redness, and 1 had pin breakage. Among the dogs, 1 had joint swelling and 1 had skin redness as complications. Diuretic and NSAID treatments were administered for 3 days to resolve edema in affected cases. For the cats with skin redness, collars were applied, and the area was treated with antiseptic twice daily, which resolved the redness. In cases with pin site discharge, the area was cleaned with antiseptic twice daily for 5 days, and discharge significantly reduced by the 6th day. The cat (case 15) with a broken external fixator pin was brought back in the 7th week. After clinical examination, the joint was stable, so the pin was removed under sedation without complications.

Follow-up

At postoperative week 8, the majority of patients demonstrated minimal or no lameness. Lameness scores ranged between 0 and 2, with most animals achieving functional weight-bearing. Detailed lesion characteristics, affected joints, etiology, postoperative week 8 lameness scores, and complications are summarized in Table 2.

Control radiographs were taken at the 4th and 8th weeks. Both the radiographs and clinical examinations confirmed that joint stabilization was maintained. The materials were removed in the 12th week, except for one case where the pin was removed in the 7th week due to breakage.

Representative radiographic examples from the cat (case 15) and the dog (case 23) are presented in Figures 4 and 5, respectively. In case 15 with bilateral antebrachiocarpal luxation, preoperative radiographs showed loss of joint congruity in both carpal joints. Postoperative anteroposterior (AP) and mediolateral (ML) radiographs showed restoration of joint alignment. Follow-up radiographs obtained at 1 month postoperatively showed maintenance of joint alignment, and radiographs acquired after removal of the external fixation materials approximately 7 weeks after surgery showed no radiographic evidence of reluxation (Figure 4). In case 23 with calcaneoquartal luxation, preoperative ML and AP radiographs showed disruption of tarsal joint alignment. Postoperative AP and ML radiographs showed restoration of joint alignment. Follow-up radiographs obtained after removal of the external fixation materials showed maintenance of joint alignment (Figure 5).

Statistical Results

Comparisons between carpal and tarsal joint lesions using the Mann–Whitney U test revealed no statistically significant differences in the 8-week lameness score, trauma-to-examination interval, examination-to-operation interval, age, or body weight (all $p>0.05$).

Cases with postoperative complications had significantly higher 8-week lameness scores compared with cases without complications, as determined by the Mann–Whitney U test ($p=0.009$). However, no significant differences were observed between the complication and non-complication groups with respect to age, body weight, trauma-to-examination interval, or examination-to-operation interval (all $p> 0.05$). Kruskal–Wallis analysis showed no statistically significant differences among lesion

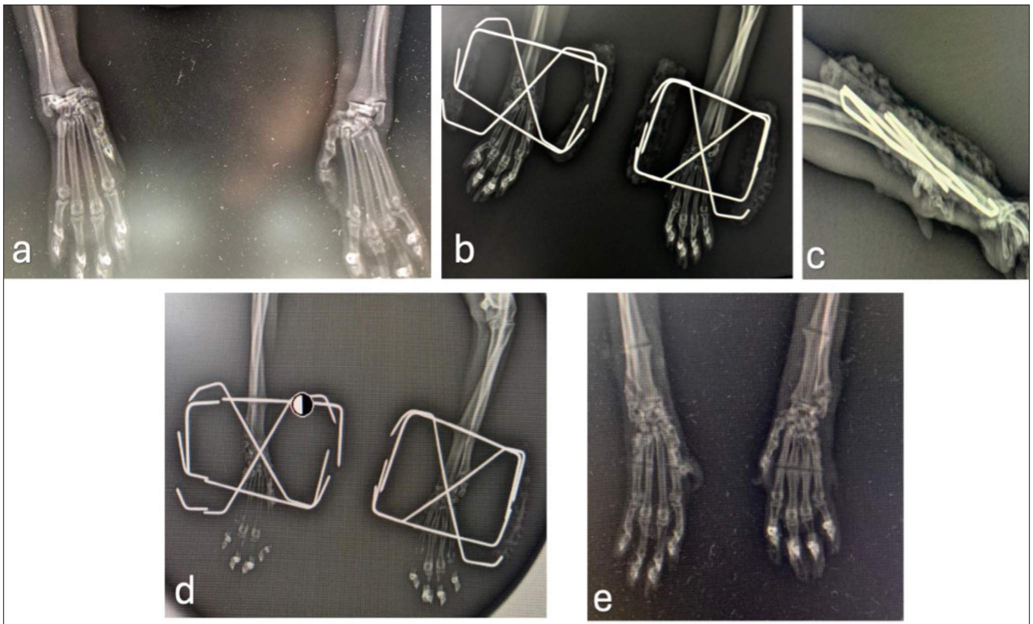

Figure 4. Radiographic images of Case 15 (cat) with bilateral antebrachiocarpal luxation. Preoperative anteroposterior (AP) radiograph (a). Postoperative AP (b), mediolateral (c) radiographs. AP radiograph obtained 7 week postoperatively (d). AP radiograph obtained after removal of the external fixation materials showing maintained joint alignment. (e).

types in terms of 8-week lameness score or other clinical variables (all p>0.05). Correlation analyses demonstrated a strong positive association between age and body weight in cats (Pearson and Spearman correlation, p<0.001). Fisher's exact test revealed no statistically significant association between the occurrence of complications and animal species (cat vs. dog) or the affected joint (carpal vs. tarsal) (p>0.05). Lesion characteristics, affected joints, etiological factors, postoperative lameness scores, and complications are summarized in Table 2.

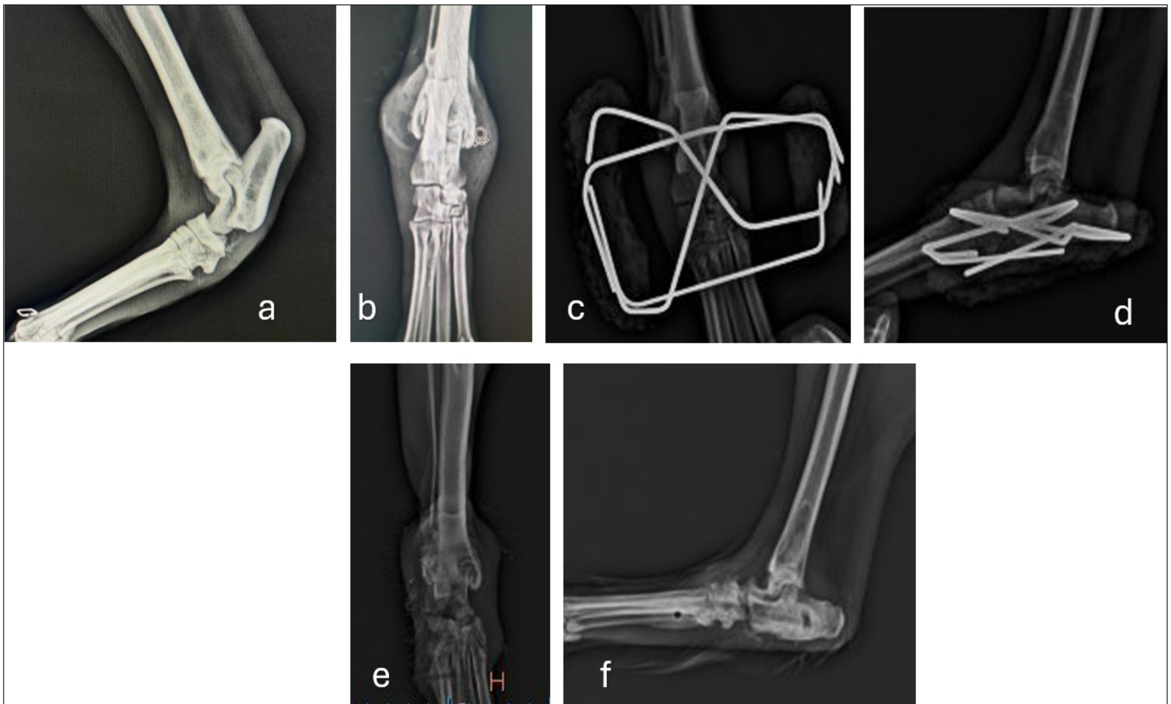

Figure 5. Radiographic images of Case 23 (dog) with calcaneoquartal luxation.Preoperative ML (a), AP (b) radiographs. Postoperative AP (c), ML (d) radiographs.AP radiograph (e), ML (f) radiographs obtained after removal of the external fixation materials in the 12. week.

Discussion

In this study, the successful short-term results of temporary stabilization of traumatic tarsal joint lesions in cats and dogs using a specially designed linear type 2 External Skeletal Fixation (ESF) system are presented for 39 patients. The closed application method with the butterfly technique shortened the surgical time, reduced complications compared to open approaches, and provided adequate stabilization.

Carpal and tarsal joint lesions in cats and dogs are primarily caused by falls from heights and traffic accidents (Beierer 2021, Dekerle et al 2025). In the present study, 52% of lesions were caused by falls from heights, and our results were consistent with other studies. We believe that the high number of cats in this study and their being housed in domestic environments contributed to this outcome.

In carpal joint instability, stabilization is typically achieved through pancarpal or partial carpal arthrodesis (Buote et a 2009, Zderic et al 2023, Iovanescu and Danielski 2025). Plate application, intramedullary pinning, crossed pinning, and external fixation methods are used techniques for arthrodesis. In external fixation, Type II ESF, Circular External Fixation (CEF), and Type IIb ESF + tie-in combinations are employed (Lesser 2014). Similarly, in tarsal joint instability, partial arthrodesis is indicated in conditions such as tarsometatarsal luxation, intertarsal instability, and ligament injuries, as well as in selected cases of fractures and osteolytic lesions (Muir and Norris 1999, Wilke et al 2000, Fettig et al 2002, Harasen, 2002, Franch et al 2004, Lundin et al 2023). Various fixation techniques, including plate application, intramedullary pinning, and external fixation, are used in these cases (Shanil et al 2006, Chow and Balfour 2012, Barnes et al 2013).

Compared with these approaches, the closed technique used in this study was preferred due to its ease of application, elimination of the need for joint curettage, improved patient tolerance, and cost-effectiveness. The use of a linear type II fixator with thermoplastic material also provided practical advantages, including material accessibility, no requirement for additional instruments, and ease of removal. These factors likely contributed to reduced surgical time and low complication rates. At the 8-week postoperative evaluation, the success rate was 97%, supporting previous findings that temporary stabilization using external fixation can be effectively applied in the management of carpal and tarsal joint instability (Tsoi et al 2025).

Joint angulation is an important factor influencing functional outcome. The normal angle of joint loading in cats and dogs is 10-12 degrees. In pancarpal arthrodesis performed with plates in dogs, the angle of the carpal joint ranged from 7-12 degrees, and in cats, the angle ranged from 10-12 degrees (Piermattei et al 2006). In the present study, we achieved joint stabilization in cats and dogs with temporary stabilization at an angle of 6-8 degrees. After the angle was applied, no issues related to weight-bearing or material complications related to joint angle were observed. This suggests that temporary stabilization within this range may be sufficient to maintain functional alignment.

Reported healing and stabilization times vary depending on the technique. In dogs undergoing partial carpal arthrodesis with crossed pins, radiographic healing occurs within 6–18 weeks (mean 9 weeks) (Willer et al 1990), while fusion times of approximately 7.4 ± 1.4 weeks in cats and dogs and around 12 weeks with circular external fixation have been described (Haburjak et al 2003, Lotsikas and Radasch 2006). In these techniques, implant removal is typically performed after joint fusion, ranging from 10 to 21 weeks in dogs and approximately 14 weeks in cats (Lotsikas and Radasch 2006, Dosseray et al 2025). Partial arthrodesis using circular or linear external fixation results in stabilization within 12–23 weeks (Halling and Lewis, 2004, Shanil et al 2006), whereas pancarpal arthrodesis achieves stabilization within 8–12 weeks (Lesser 2014). In cats and dogs, external fixation applied in cases of tarsal joint instability has been removed within 28-56 days (Diamond et al 1999, Vannini and Bonath 2005, Roch et al 2009, Kulendra et al 2011), while other studies report removal times of 14–16 weeks (Diamond et al 1999, Roch et al 2009, Kulendra et al 2011). McLennan (2007) also demonstrated that in the absence of joint curettage, ankylosis may occur between 12–17 weeks prior to fixator removal.

Unlike arthrodesis techniques, this method relies on periarticular fibrosis for stabilization; therefore, direct comparison with fusion-based timelines is limited. Nevertheless, clinical and radiographic evaluations at 8 weeks confirmed that joint stability was achieved and maintained. The fixator was removed at 12 weeks, which may reflect the minimally invasive nature of the technique and the avoidance of joint curettage, allowing adequate stabilization without prolonged immobilization.

After crossed pin application in carpal joints, 30% pin migration, 35% bandage wounds, 22% proximal carpal joint ankylosis, and 4% osteomyelitis were reported (Haburjak et al 2003). In the present study, complication rates were considerably lower, with minor complications observed in a limited number of cases, including pin tract infection, skin irritation, and a single instance of pin breakage. The complications were resolved with conservative management, and no recurrence of instability was observed after implant removal. The relatively low complication rate may be attributed to the closed surgical approach, which minimizes soft tissue disruption and reduces infection risk, as well as appropriate pin diameter selection and the biomechanical stability provided by the butterfly-shaped fixation configuration. This configuration likely facilitates more effective distribution of mechanical forces across the joint, thereby reducing implant-related complications and improving overall clinical outcomes (Prackova et al 2022).

Conclusion

In 39 patients, joint stabilization was successfully achieved by bringing the carpal and tarsal joints to their anatomical positions without joint curettage. This study concluded that temporary immobilization for 8-12 weeks is sufficient to promote periarticular fibrosis in carpal and tarsal joints. Furthermore, we observed a significant reduction in complication rates compared to other techniques using the modified external fixation method developed in this study. This technique can safely and effectively serve as an alternative to arthrodesis in the treatment of irreversible damage to the carpal and tarsal joints.

Declarations

Competing Interests

The authors declare that they have no conflict of interest regarding the publication of this article.

Availability of Data and Materials

The data that support the findings of this study are available on request from the corresponding author.

Ethical Statement

This study was reviewed by the Animal Experiments Local Ethics Committee of Istanbul University–Cerrahpaşa (Approval No: E-74555795-050.04-1215854; Date: 29 January 2025), which determined that ethical approval was not required in accordance with Article 8(k) of the “Regulation on Working Procedures and Principles of Animal Experiments Ethics Committees.

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Author Contributions

Motivation / Concept: EEY, KA; Design: YA, KA; Control/ Supervision: KA; Data Collection and / or Processing: EEY, YA; Analysis and / or Interpretation: EEY; Literature Review: YA, EEY; Writing the Article: EEY, YA, KA; Critical Review: EEY

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