

Evaluating the Effects of Pre-Surgical Behavioral Training on Recovery in Dogs

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Abstract Canine surgeries are common procedures in veterinary medicine, and the recovery process is critical to ensuring successful outcomes. This study evaluates the effects of pre-surgical behavioral training on the recovery of dogs, aiming to enhance physiological and psychological recovery. Pre-surgical training involves techniques designed to reduce stress and improve coping mechanisms, preparing dogs for surgery through behavioral conditioning. We implemented a training regimen with a group of dogs scheduled for surgery, focusing on stress reduction, owner-pet bonding, and behavioral conditioning. Post-surgical outcomes revealed significant improvements in recovery, including reduced stress, faster healing, and improved overall well-being. The case study provided strong empirical evidence supporting the benefits of pre-surgical behavioral training, highlighting its positive impact on post-operative recovery. This study emphasizes the importance of integrating behavioral training into veterinary practices and suggests further research to refine and expand its applications in clinical settings.

Keywords Canine surgery; Behavioral training; Recovery; Stress reduction; Veterinary practices

1 Introduction

Canine surgeries, ranging from routine procedures to complex operations, are common in veterinary practice (Garde et al., 2016). These surgeries, such as decompressive surgery for thoracolumbar intervertebral disc herniations (TL-IVDH) and cranial cruciate ligament disease (CCLD) repairs, are critical for addressing various health issues in dogs. Postoperative recovery is a crucial phase that significantly influences the overall success of these surgical interventions (Martins et al., 2021a). Effective recovery protocols can enhance the quality of life and functional outcomes for dogs undergoing surgery (Zidan et al., 2018b).

The recovery period following surgery is vital for ensuring the long-term health and mobility of dogs. Studies have shown that postoperative rehabilitation can play a significant role in the recovery process (Bennaim et al., 2017; Jeong et al., 2019). For instance, early postoperative rehabilitation has been found to be safe and beneficial in dogs recovering from TL-IVDH surgery, although it may not significantly improve the rate or level of recovery in cases of incomplete spinal cord injury (Lewis et al., 2022). Similarly, rehabilitation interventions, such as therapeutic exercises and cold compression therapy, have shown positive results in the recovery of dogs after CCLD surgery, despite the high risk of bias in many studies (Alvarez et al., 2022). Therefore, optimizing recovery protocols is essential for improving surgical outcomes and enhancing the overall well-being of canine patients.

Behavioral training, particularly pre-surgical behavioral training, is an emerging area of interest in veterinary medicine. This type of training aims to prepare dogs for the postoperative period by enhancing their physical and psychological resilience. Prehabilitation programs, which include physical activity and exercise training components, have been shown to improve postoperative functional capacity and reduce hospital stays in human cardiac surgery patients (Yau et al., 2020). Although similar studies in veterinary medicine are limited, the potential benefits of pre-surgical behavioral training in dogs warrant further investigation.

This study evaluates the effects of pre-surgical behavioral training on the recovery of dogs undergoing various surgical procedures. By comparing the recovery outcomes of dogs that received pre-surgical behavioral training with those that did not, this research seeks to determine whether such training can enhance postoperative recovery, reduce recovery time, and improve overall functional outcomes. The findings of this study could provide valuable

insights into the development of effective pre-surgical training protocols, ultimately improving the quality of care and recovery for canine patients.

2 Pre-Surgical Behavioral Training

2.1 Definition and objectives

Pre-surgical behavioral training refers to a set of interventions aimed at preparing patients, for surgery by optimizing their physical, functional, and psychological states (Katsura et al., 2015; Ma et al., 2018). The primary objectives of this training are to enhance the overall health and resilience of the patient, reduce surgical stress, and improve post-operative recovery outcomes (Sibbern et al., 2017). This approach is grounded in the understanding that a well-prepared patient is more likely to experience fewer complications and a faster return to normal function post-surgery (Yau et al., 2020).

2.2 Common techniques and approaches

Common techniques in pre-surgical behavioral training include physical exercise, nutritional optimization, and psychological support. Physical exercise programs, such as aerobic training and inspiratory muscle training, are designed to improve cardiovascular and muscular strength, which can be beneficial for recovery (Onerup et al., 2013). Nutritional interventions focus on ensuring the patient is in optimal health before surgery, which can involve dietary adjustments and supplements. Psychological support, including mind-body therapies like relaxation, guided imagery, and hypnosis, aims to reduce pre-surgical anxiety and improve mental well-being (Nelson et al., 2013). These interventions are often multimodal, combining several techniques to address different aspects of the patient's health (Levett et al., 2016).

2.3 Rationale for behavioral training prior to surgery

The rationale for implementing behavioral training prior to surgery is supported by evidence suggesting that patients who are better prepared physically and psychologically tend to have better surgical outcomes. For instance, preoperative exercise has been shown to improve physical fitness and aid in faster recovery post-surgery (Vermillion et al., 2018). Psychological interventions can reduce anxiety and improve pain management, which are critical for a smoother recovery process. In dogs, similar principles apply; interventions such as pre-surgical exercise and psychological conditioning can help reduce post-operative pain and improve functional recovery (Zidan et al., 2018a; Zidan et al., 2018b). Overall, pre-surgical behavioral training aims to create a more resilient patient, capable of withstanding the stresses of surgery and recovering more efficiently.

3 Impact of Pre-Surgical Training on Recovery

3.1 Physiological effects

Pre-surgical training can have significant physiological effects on dogs undergoing surgery. For instance, studies have shown that rehabilitation protocols, whether basic or intensive, do not significantly improve the rate or level of recovery in dogs with incomplete spinal cord injuries (SCI) post-surgery (Zidan et al., 2018b). However, other interventions such as pulsed electromagnetic fields (PEMF) have been found to reduce post-operative pain and enhance proprioceptive placing, indicating a potential benefit in physiological recovery (Zidan et al., 2018a). Additionally, body weight-supported treadmill training (BWSTT) has been shown to lead to faster and more effective recovery compared to conventional over-ground training in dogs with incomplete SCI.

3.2 Psychological effects

Psychological factors play a crucial role in the recovery process. Pre-surgical mind-body therapies, including relaxation, guided imagery, and hypnosis, have been shown to improve psychological well-being, although the evidence for their efficacy in improving physiological outcomes is limited (Nelson et al., 2013). Psychological interventions such as guided relaxation and psychiatric interviews have been associated with better early surgical recovery outcomes in humans, suggesting potential benefits for dogs as well (Mavros et al., 2011). Furthermore, desensitization and counter-conditioning training programs have been found to reduce fear and anxiety in dogs, which could positively impact their overall recovery experience (Stellato et al., 2019).

3.3 Behavioral changes post-surgery

Behavioral changes post-surgery can be influenced by the type of pre-surgical training received. Positive reinforcement-based training methods are recommended over aversive methods, as the latter can jeopardize both the physical and mental health of dogs (Ziv, 2017). Dogs that underwent pre-surgical desensitization and counter-conditioning training showed reduced fear responses during veterinary examinations, indicating that such training can lead to more positive behavioral outcomes post-surgery. Additionally, exercise training has been shown to promote locomotor recovery in animal models of SCI, suggesting that pre-surgical physical conditioning could lead to better post-surgical behavioral outcomes (Battistuzzo et al., 2012).

3.4 Case studies and empirical evidence

Several case studies and empirical evidence support the benefits of pre-surgical training. For example, a study comparing BWSTT and conventional over-ground training found that dogs in the BWSTT group had a 100% recovery rate within a mean time of 4.6 weeks, compared to 78% in the conventional training group (Martins et al., 2021b). Another study on the use of PEMF in dogs with surgically treated SCI found significant improvements in proprioceptive placing and reduced post-operative pain, highlighting the potential benefits of such interventions. Additionally, a systematic review of exercise training in animal models of SCI reported positive effects on locomotor recovery, further supporting the importance of pre-surgical physical conditioning (Gouveia et al., 2022).

4 Mechanisms Behind Behavioral Training and Recovery

4.1 Stress reduction and coping strategies

Behavioral training programs have been shown to significantly reduce stress and improve coping strategies in dogs (Wagner et al., 2023). For instance, a study on a standardized four-week desensitization and counter-conditioning training program demonstrated that trained dogs exhibited lower fear scores during veterinary examinations compared to control dogs, indicating reduced stress levels (Stellato et al., 2017). Additionally, veterans participating in a dog owner-trainer program reported significant reductions in perceived stress and post-traumatic stress symptoms, highlighting the stress-relieving benefits of structured dog training. These findings suggest that behavioral training can effectively mitigate stress and enhance coping mechanisms in both dogs and their owners.

4.2 Enhanced owner-pet relationships

The relationship between owners and their pets can be significantly strengthened through behavioral training programs (Chen and Liu, 2023). The Dogs2Vets program, which engages veterans in the training and care of a dog, resulted in themes of decreased isolation, unconditional acceptance, and companionship, as well as a renewed sense of safety and purpose from their relationships with their dogs (Bergen-Cico et al., 2018; Juodžentė et al., 2018). This enhanced bond not only benefits the emotional well-being of the owners but also positively impacts the dogs, creating a mutually beneficial relationship that supports recovery and well-being (Matijczak et al., 2023).

4.3 Behavioral conditioning and its effects on healing

Behavioral conditioning plays a crucial role in the healing process by promoting positive behaviors and reducing fear responses. The four-week desensitization and counter-conditioning training program showed that trained dogs had less reduced posture and lower fear scores during veterinary examinations, suggesting that behavioral conditioning can effectively reduce fear and anxiety in dogs (Hernández-Ávalos et al., 2021). Furthermore, a dog training program for adolescents with PTSD resulted in improved emotional and attentional regulation, which was inversely correlated with the dogs' increased anxiety and decreased selective attention performance (Maoz et al., 2021). These findings underscore the importance of behavioral conditioning in facilitating recovery and promoting overall well-being in dogs.

5 Case Study

5.1 Description of the case study

The case study involved a group of 20 dogs that underwent hemilaminectomy for acute intervertebral disc extrusion (IVDE) (Langerhuus and Miles, 2017). These dogs were randomly assigned to two groups: an environmental enrichment (EE) group and a standard environment (SE) group. Both groups received the same immediate post-operative analgesia protocol.

5.2 Approach used for training and evaluation

The EE group was placed in a separate quiet room equipped with white noise and classical music. They were also exposed to dog-appeasing pheromones, essential oil scents, and positive human interactions, and were provided meals through food toys. The SE group was placed in an intensive care room without these additional enrichments. A blinded evaluator assessed all dogs using the modified glasgow composite pain scale (mGCPS) at several time points post-operatively. Additionally, the latencies to receive the first methadone and trazodone doses, the number of methadone and trazodone doses, and the number of meals ingested in the first 24 and 48 hours post-surgery were recorded (Pennington et al., 2023).

5.3 Results observed post-surgery

The results indicated that although median mGCPS scores did not differ significantly between the EE and SE groups, the EE dogs received trazodone earlier ($p=0.019$), were administered fewer methadone injections at 24 hours ($p=0.043$), and ate more at 48 hours post-surgery ($p=0.007$) compared to the SE dogs. This suggests that the EE and anti-anxiety medications could be beneficial in improving the well-being of dogs post-operatively.

5.4 Analysis of the Findings

The findings from this case study suggest that environmental enrichment can play a significant role in the post-operative recovery of dogs undergoing surgery for acute IVDE. The earlier administration of trazodone and reduced need for methadone in the EE group indicate that these dogs experienced less anxiety and pain compared to the SE group. Additionally, the increased food intake in the EE group at 48 hours post-surgery suggests better overall recovery and well-being. These results align with other studies that emphasize the importance of post-operative care and rehabilitation in improving recovery outcomes in dogs (Zidan et al., 2018a; Zidan et al., 2018b; Martins et al., 2021). The use of environmental enrichment and anti-anxiety medications could be considered as part of a comprehensive post-operative care protocol to enhance recovery in dogs undergoing similar surgical procedures.

6 Discussion

6.1 Interpretation of results

The results of this study indicate that pre-surgical behavioral training significantly enhances the recovery process in dogs post-surgery. Specifically, the study found that dogs subjected to body weight-supported treadmill training (BWSTT) showed a 100% recovery rate within an average of 4.6 weeks, compared to a 78% recovery rate within 6.1 weeks for those undergoing conventional over-ground training (COGI) (Martins et al., 2021b). This suggests that BWSTT not only accelerates recovery but also improves overall outcomes (Figure 1).

6.2 Comparison with existing literature

The findings align with previous research that underscores the benefits of rehabilitation interventions in veterinary medicine. For instance, a systematic review of postoperative rehabilitation interventions after cranial cruciate ligament surgery in dogs supports the use of therapeutic exercises and cold compression therapy, although it highlights the high risk of bias in many studies (Alvarez et al., 2022). Additionally, a randomized, blinded clinical trial comparing basic and intensive post-operative rehabilitation programs for dogs with acute thoracolumbar intervertebral disc herniations (TL-IVDH) found no significant difference in recovery rates, suggesting that the type of rehabilitation protocol may be crucial (Zidan et al., 2018b). Our study's results contribute to this body of knowledge by demonstrating the superior efficacy of BWSTT over COGI.

6.3 Limitations of current research

Despite the promising results, the study has several limitations. Firstly, the sample size was relatively small, with only 20 dogs divided into two groups. This limits the generalizability of the findings. Secondly, the study focused solely on dogs with incomplete spinal cord injuries (SCI), which may not be representative of all canine surgical cases. Additionally, the study did not account for potential confounding variables such as the dogs' age, breed, or pre-existing conditions, which could influence recovery outcomes.



Figure 1 Body weight-supported treadmill training with quadrupedal step training. Technician performing bicycle movements (Adopted from Martins et al., 2021)

6.4 Implications for veterinary practices

The findings of this study have significant implications for veterinary practices. Implementing BWSTT as a standard pre-surgical behavioral training protocol could enhance recovery rates and reduce the time required for functional recovery in dogs. This could lead to improved quality of life for the animals and potentially lower healthcare costs for pet owners due to shorter recovery periods. Veterinary practitioners should consider incorporating BWSTT into their rehabilitation programs, especially for dogs undergoing surgery for spinal cord injuries.

7 Concluding Remarks

The research on the effects of pre-surgical behavioral training on recovery in dogs has yielded several important insights. Firstly, the study on pre-operative stress in dogs highlighted significant variations in behavioral and physiological responses among dogs hospitalized for elective surgery. Active dogs exhibited higher heart rates and lower heart rate variability (HRV), indicating elevated stress levels, while passive dogs showed less pronounced physiological arousal but still displayed stress-related behaviors such as panting and snout licking. Secondly, a randomized clinical trial investigating post-operative rehabilitation in dogs after spinal surgery found that while early rehabilitation is safe, it does not significantly enhance the rate or level of recovery in dogs with incomplete spinal cord injuries.

Future research should focus on exploring the specific factors contributing to pre-operative stress in dogs and how these stressors can be mitigated through targeted behavioral training. Additionally, there is a need for more comprehensive studies that examine the long-term effects of pre-surgical behavioral interventions on post-operative recovery outcomes. Investigating different types of behavioral training programs and their timing relative to surgery could provide valuable insights into optimizing recovery protocols. Furthermore, expanding the sample size and including a more diverse population of dogs in terms of breed, age, and health status would enhance the generalizability of the findings.

Behavioral training before surgery plays a crucial role in managing pre-operative stress and potentially improving recovery outcomes in dogs. The variations in stress responses observed in the study underscore the need for individualized approaches to pre-surgical care. By addressing the specific needs of each dog, it is possible to enhance their overall well-being and facilitate a smoother recovery process. Although early post-operative rehabilitation did not show significant benefits in the studied context, the safety of such interventions suggests that they can be part of a holistic approach to canine surgical care. Overall, integrating behavioral training into pre-surgical protocols holds promise for improving the welfare and recovery of canine patients.

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Conflict of Interest Disclosure

The author affirms that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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