

Summary of the DVSc thesis No: 18207, Faculty of Veterinary Medicine, Urmia University

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Author: Mohammad Mahdi Gooran

Title of thesis: Evaluation of the Pedicle screw-Rod implantation for experimentally induced tibial fracture in dog.

Summary

In recent years, significant progress has been made in atraumatic techniques for bone fracture fixation, commonly referred to as minimally invasive osteosynthesis (MIO). For veterinary surgeons, it is essential to offer a bone fixation method that is minimally invasive yet strong enough to facilitate early and painless limb movement. Pedicle screws (PS) are primarily used for internal spinal fixation to correct deformities and stabilize the spine until solid fusion is achieved. Based on research across various databases, to our knowledge, no studies have been conducted on the use of the Pedicle screw-Rod (PS-R) configuration for fixing fractures or osteotomies in long bones. Our study aimed to evaluate the efficiency, performance, and biocompatibility of this implant as an external fixation method for tibial osteotomy, introducing a novel surgical approach for stabilizing this bone. With the approval of the Animal Care and Ethics Committee, five healthy, non-sterilized male mixed-breed dogs, weighing 20-22 kg and aged 10-12 months, underwent aseptic tibial osteotomy fixation using the PS-R configuration. All dogs were placed in a single treatment group. Postoperative evaluations included clinical, radiological, and ultrasound assessments at the osteotomy site, along with histological examinations at the bone-screw interface. All animals began weight-bearing within 24 hours after surgery. No complications were observed during the recovery period, and the fixation device functioned effectively until removal. The lameness grade score improved to the ideal level by 21 days postoperatively in all animals. Clinical bone union occurred at 5.8 ± 1.30 weeks, with complete bone union achieved at 11.4 ± 1.51 weeks post-surgery. Postoperative mechanical medial proximal and distal tibial angles were, 92.00° (92.00° , 91.50°) and $93.40^\circ \pm 1.14^\circ$, respectively. The tibial valgus was $5.20^\circ \pm 1.48^\circ$, and tibial plateau angles measured 22.00° (23.00° , 22.00°). There were no significant differences noted when comparing values before and after the operation. Postoperative rotational alignment was anatomical, with satisfactory bone apposition. B-mode ultrasound evaluation indicated healing progress at all osteotomy sites. The color Doppler examination revealed an initial increase in signals in the surrounding soft tissue during the first four weeks post-operation, followed by a decrease in signals within the adjacent soft tissue between the fifth and eighth weeks. During this latter period, the signals were primarily concentrated on the bone surface and the callus. The bone-screw interface at various screw sites exhibited similar histological changes, indicating effective integration of the newly formed woven bone into the screw threads. Fixation of non-articular tibial osteotomy with Pedicle Screw-Rod configuration resulted in secondary bone healing, characterized by abundant callus formation and neovascularization. This implant demonstrated favorable biocompatibility with bone and surrounding soft tissue, without significant complications.

Key words: Bone fixation, Osteotomy, Tibia, Dog, Pedicle screw