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Effect of Physiotherapy during the Postoperative Period of Long-Bone Surgeries in Dogs

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Abstract

Postoperative physiotherapy is increasingly recognized as a key component of successful recovery after long-bone surgery in dogs. Physiotherapy aims to reduce pain and swelling, preserve joint's range of motion (ROM), maintain muscle mass, accelerate return to function, and potentially improve bone and soft-tissue healing through optimized loading and circulation. This article discusses the physiological rationale for perioperative rehabilitation, summarizes commonly used modalities, proposes an evidence-informed phased protocol for the immediate-to-late postoperative periods, outlines objective outcome measures, discusses practical and safety considerations, and suggests designs for future clinical trials to produce high-quality evidence. Practical recommendations are outlined for clinicians and rehabilitation practitioners managing canine patients after fractures, corrective osteotomies, and fracture fixation procedures.

Keywords: canine, postoperative rehabilitation, physiotherapy, long-bone surgery, fracture, hydrotherapy, passive range of motion, neuromuscular electrical stimulation

INTRODUCTION

Long-bone surgeries in dogs (fracture repair, corrective osteotomy, etc.) frequently result in postoperative pain, joint stiffness, muscle atrophy, disuse osteopenia, and impaired gait. Traditional postoperative care focusing on rest and analgesia reduces immediate complications but may delay functional recovery. Physiotherapy (also called as rehabilitation) provides targeted interventions to counteract these sequelae, leveraging mechanical and neuromuscular stimuli to hasten return to function. While human orthopedics has long integrated structured rehabilitation into postoperative care, veterinary evidence is more heterogeneous; nonetheless, clinical experience and physiological principles support systematic physiotherapy for many canine patients.

PHYSIOLOGICAL RATIONALE

a) **Pain modulation:** Movement, controlled loading and modalities (cold therapy, TENS therapy and laser therapy) can reduce nociceptive input and central sensitization of pain.

b) **Maintenance of ROM:** Early controlled passive and active range of motion (ROM) prevents capsular and peri-articular fibrosis.

c) **Muscle preservation & neuromuscular re-education:** Exercises and electrical stimulation maintain muscle mass, muscle strength, and motor unit

recruitment and therefore reduces disuse atrophy.

d) **Bone healing and mechano-transduction:** Controlled mechanical loading (within safe limits dictated by fixation stability) promotes callus formation and remodeling via mechano-transduction.

e) **Circulation & edema control:** Manual techniques, compression, and movement enhance venous and lymphatic return, decreasing swelling and improving tissue oxygenation.

INDICATIONS OF COMMON PHYSIOTHERAPY MODALITIES

1. **Cryotherapy (cold packs, cold compression):** Immediate postoperative phase to reduce pain and swelling. It is performed for short durations of 10–20 minutes session several times daily.
2. **Thermotherapy (heat packs):** Thermotherapy is indicated during the later phases i.e., once acute inflammation subsides, to increase tissue extensibility prior to stretching.
3. **Passive Range of Motion (PROM):** Gentle controlled PROM exercises are started early to maintain joint mobility. These exercises are performed multiple times daily in short sets. Avoid any aggressive stretching that stresses fixation.
4. **Active Assisted/Active ROM & Strengthening Exercises:** These exercises are initiated as the weight bearing by the patients increases. Such exercises include sit-to-stand, controlled leash walks, step ups, and resistance exercises as tolerated by the patients.
5. **Hydrotherapy (underwater treadmill, swimming):** This modality provides buoyancy to reduce weight bearing while enabling gait retraining and strengthening; start when incision healed and fixation stable.
6. **Gait training:** Focused leash work, figure-8s, and progressive exposure to uneven surfaces to restore proprioception.
7. **Neuromuscular Electrical Stimulation (NMES)/TENS:** NMES is used for muscle activation and strength preservation while transcutaneous electrical nerve stimulation (TENS) is used for analgesia. Parameters appropriate for species and size should be used and skin and muscle responses should be monitored.
8. **Massage & soft tissue mobilization:** Massaging with fingers, fist or palm in a circular or divergent fashion provides short-term analgesia, reduces adhesions, and promotes circulation to the affected parts.
9. **Laser/Photobiomodulation therapy:** Low-level laser therapy (LLLT) is used as an adjunct to provide analgesic and tissue-healing effects protocols. Direct exposure to eyes of the user as well as the patient should be avoided.
10. **Compression devices & bandaging:** Compression bandaging using crepe bandage or tape control edema and protect soft tissues. This also relieves pain by removing the inflammatory exudates effect on stretch receptors of muscles in the affected part.
11. **Continuous Passive Motion (CPM) devices:** The application of CPM devices

is rare in veterinary practice but conceptually similar to be used in maintaining joint motion without active muscle contraction.

TIMING AND PHASED PROTOCOLS

Timing must be individualized depending on the patient, their temperament, fracture type, fixation stability, surgeon instructions, and pain control. The operating surgeon must be consulted before starting any physiotherapy modality or its protocol. Following table details about various phases, their goals and protocols of physiotherapeutic modalities:

Phase 0 — Immediate postoperative (0 to 48 or 72 hours)
➢ **Goals**: Analgesia, edema control, protect fixation. • Strict rest as per surgeon (often crate rest). • Cryotherapy: 10–15 min every 4–6 hours. • Analgesia per clinician. • Gentle PROM (if fixation and pain permit): 2–3 times daily, 5–10 repeats per joint, within comfortable range. • Isometric muscle activation (patient-initiated minimal contractions) if tolerated.
Phase 1 — Early (3 days to 2 weeks)
➢ **Goals**: Protect repair, prevent stiffness & atrophy, and gradually reintroduce limb use. • Continue PROM; progress to active assisted ROM as pain allows. • Short leash controlled ambulatory sessions 2–3 times daily (duration per surgeon). • Begin NMES for quadriceps/shoulder muscle activation when patient cannot perform effective voluntary contraction. Typical sessions 10–20 min, multiple times weekly. • Gentle massage and soft tissue mobilization outside the incision area.
Phase 2 — Intermediate (2–6 weeks)
➢ **Goals**: Increase weight bearing, begin strengthening & proprioception. • Progressive weight-bearing exercises; increase leash walk durations slowly. • Hydrotherapy (underwater treadmill) if incision healed and surgeon approves 2–3 sessions/week initially short (5–10 min) progressing in duration. • Introduce low-load strengthening (sit-to-stand, incline walking). • Continue ROM and NMES as needed.
Phase 3 — Late (6 weeks onward)
➢ **Goals**: Restore full function, strength, endurance, and return to activity. • Progressed land-based strengthening (resisted walking, cavaletti poles, stair climbing) tailored to patient. • Increase hydrotherapy intensity and duration. • Sports or activity-specific retraining for working or athletic dogs once bone union is confirmed. • Monitor for compensatory patterns; address pelvic/humeral limb imbalances.

OUTCOME MEASURES

- **Objective measures:** Force plate/pedobarography, kinematic gait analysis, limb circumference (muscle mass), joint ROM (goniometry), radiographic assessment of bone healing, timed walking tests and accelerometry.
- **Subjective/Clinical:** Pain scores (validated scales), lameness grading,

owner-reported functional questionnaires, incision and complication monitoring.

- Use baseline preoperative or immediate postoperative measures when possible.

AN OVERVIEW OF EVIDENCE SUMMARY & PRACTICAL EFFICACY

Evidenced based veterinary literature and clinical experience support beneficial effects of structured rehabilitation on pain control, ROM preservation, reduced atrophy, and faster return to ambulation after orthopedic surgery in dogs. However, randomized controlled trials are limited and heterogeneous in design, modalities, and outcome measures. Modalities with consistent practical utility include PROM, controlled leash walks, hydrotherapy, and NMES. Modalities such as laser therapy and CPM show variable reported benefits and require further controlled study. Importantly, the timing and intensity of rehabilitation must respect fixation stability—early aggressive loading risks hardware failure and nonunion.

Safety: Analgesia coordination- effective multimodal analgesia improves tolerance and participation in physiotherapy.

Contraindications: Unstable fixation or grossly unstable fracture site, non-healed skin/incision (for hydrotherapy), uncontrolled infection, uncontrolled systemic disease, severe pain not controlled by analgesia.

Precautions: Always follow surgeon's weight-bearing restrictions; monitor wound healing; avoid movements that produce stress at the repair site; monitor for increased pain, swelling or lameness that suggests complication.

PRACTICAL CLINICAL CONSIDERATIONS

- **Individualization:** tailor protocols based on fracture type, fixation stability, patient age, temperament, comorbidities, body condition, and owner compliance.
- **Owner education:** critical for home exercise adherence, incision monitoring, and safe activity progression. Provide simple written protocols and demonstrations.
- **Multidisciplinary approach:** close communication among surgeon, rehabilitation therapist, and primary clinician optimizes timing and safety.
- **Equipment & environment:** access to hydrotherapy, NMES devices, and trained personnel improves outcomes but is not strictly necessary—many benefits are achievable with simple PROM, controlled walks, and progressive exercises.

DESIGNING FUTURE CLINICAL TRIALS (RECOMMENDED FRAMEWORK)

To strengthen evidence, propose randomized controlled trials with:

- Clear inclusion criteria (e.g., closed diaphyseal tibial fractures stabilized with plating; adult dogs 1–8 years).
- Standardized surgical fixation and postoperative analgesia across groups.
- Intervention arms: standardized physiotherapy protocol vs standard care (rest/analgesia), with possible stratification by modality (hydrotherapy, NMES).
- Primary outcomes: objective kinetic data (peak vertical force) and time to functional milestones (independent ambulation). Secondary outcomes: ROM, muscle mass, radiographic union time, owner satisfaction, complication rates.
- Adequate sample size and blinded assessors.

- Follow-up at standardized intervals (2, 6, 12, 24 weeks).
- Cost-effectiveness and owner compliance assessment.

LIMITATIONS

Heterogeneity of existing studies (modalities, timing, and outcome metrics) hampers meta-analysis. Many reports are small case series or retrospective; high quality RCTs are scarce. Difficulty standardizing owner-performed home exercises and measuring adherence.

CONCLUSION

Physiotherapy is a valuable adjunct in postoperative care after long-bone surgery in dogs, with plausible physiologic benefits and broad clinical acceptance. A phased, individualized rehabilitation program—starting with pain/edema control and PROM, progressing to muscle activation, hydrotherapy, and strength/endurance training—optimizes recovery while mitigating risks. Close coordination with the surgical team is essential to align rehabilitation intensity with fixation stability. High-quality randomized studies using objective outcome measures are needed to quantify the magnitude of benefit for specific modalities and protocols.

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