Principles and Application of Range of Motion and Stretching in Companion Animals

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KEYWORDS

• Dog • Joint motion • Range of motion • Passive range of motion • Stretching • Flexibility • Contracture

KEY POINTS

- Joint motion is a fundamental aspect of locomotion and activities of daily living.
- Joint motion may be restricted in companion animals after injury, surgery, or as a response to acute or chronic conditions.
- Range of motion and stretching exercises are commonly used in companion animal rehabilitation programs to maintain or improve the motion of musculoskeletal tissues and skin.
- Stretching exercises are a critical aspect of the management of joint contractures and myopathies.

INTRODUCTION

Optimal locomotion and activities of daily living require adequate motion of joints, muscles, tendon, fascia, and skin. The motion of these tissues can be negatively affected by injuries, surgery, and by acute and chronic conditions. Joint motion may be transiently or permanently lost. Range of motion (ROM) and stretching exercises positively affect tissue motion and may prevent future injuries from occurring. This article presents the general principles of ROM and stretching exercises, discusses the pathophysiology of problems negatively affecting tissue motion, and reviews the clinical applications of ROM and stretching exercises in companion animals.

ASSESSMENT OF JOINT MOTION

The appreciation of loss of joint motion requires the assessment of joint motion using a goniometer. Most often, clinicians focus on joint motion in a sagittal plane: flexion and

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extension, because that is the primary motion of joints. The method for measuring flexion and extension using a goniometer has been standardized and validated in dogs and cats.[1–3] In Labrador retrievers, for example, passive joint flexion and extension (ROM) is 32° to 196° (total of 164°) in the carpus, 36° to 165° (129°) in the elbow, 57° to 165° (108°) in the shoulder, 39° to 164° (125°) in the tarsus, 42° to 162° (120°) in the stifle, and 50° to 162° (112°) in the hip joint. Cats have a passive joint flexion and extension (ROM) of 22° to 198° (total of 176°) in the carpus, 22° to 163° (141°) in the elbow, 32° to 163° (131°) in the shoulder, 21° to 167° (146°) in the tarsus, 24° to 164° (140°) in the stifle, and 33° to 164° (131°) in the hip joint. There are some differences in joint motion among dog breeds. For example, compared with Labrador retrievers, German shepherds dog have differences in passive joint flexion and extension for the elbow, shoulder, tarsus, stifle, and hip (ie, all joints except the carpus).[3] German shepherd dogs' joints flex more (∼10°) and extend less (∼10°) than those of Labrador retrievers but overall their joints have the same ROM. The difference between Labrador retrievers and German shepherds dog is associated with Labradors being more upright than Shepherds when they stand and walk. It is not clear whether the Shepherds' gait is the consequence of their joint motion or whether the joint motion is the consequence of their gait. The gaits of Labrador retrievers and Rottweilers trotting on a treadmill were compared. Minor differences (<9°) in carpal, elbow, tarsal, and stifle motion were identified.[4] Obesity has been shown to alter gait. In a study comparing the trot of lean and obese mixed breed dogs, stance phase ROM was greater in obese dogs than in lean dogs in the shoulder (28° vs 21°), elbow (24° vs 16°), hip (27° vs 23°), and tarsal (39° vs 28°) joints.[5] Swing phase ROM was greater in obese dogs than in lean dogs in the elbow (61° vs 54°) and hip (34° vs 30°) joints. Other dog breeds also can have idiosyncratic joint motion that is the result of anatomic issues. For example, greyhounds seem to have less tarsal flexion than Labrador retrievers. The motion of joints is influenced by muscle mass, particularly when muscles of different limb segments can interfere with joint flexion. For example, dogs with muscular pelvic limbs seem to have less stifle flexion than dogs with slender pelvic limbs, and this may also be the reason why cats seem to be able to flex most joints more than dogs despite having similar extension. Joint motion is also influenced by the shape of limbs. For example, chondrodystrophic dogs with antebrachial angular deformities often lack carpal flexion, even in the absence of radiographic signs of osteoarthritis (OA) in their carpi.[6] Although joint motion is essential to being able to use a limb, some types of joint motion are required for limb use and some are not. As a general rule, the motion that is required for limb use corresponds with the ROM used at the walk and trot, and also the gallop if galloping is part of the dog's activities. At a walk, in a kinematic analysis of Labrador retrievers, the flexion and extension (ROM) of the main limb joints were estimated to be 128° to 238° (110° of ROM) in the carpus, 91° to 146° (54°) in the elbow, 88° to 125° (36°) in the shoulder, 111° to 145° (34°) in the tarsus, 111° to 146° (35°) in the stifle, and 111° to 147° (36°) in the hip joint.[7] To go from sit to stand in the same group of dogs, the motion was 133° to 202° (70° of ROM) for the carpus, 109° to 147° (37°) in the elbow, 91° to 119° (27°) in the shoulder, 95° to 131° (35°) in the tarsus, 46° to 108° (62°) in the stifle, and 49° to 115° (66°) in the hip joint.[7] These flexion values correspond with sitting position and these extension values correspond with a standing position. Measurements of joint motion differ slightly in other studies involving kinematic analysis because of differences in methodology, particularly differences in marker placement.

It is important to put loss of joint motion in perspective because the functional consequences of loss of joint motion vary widely. A dog with a loss of passive joint motion that does not overlap the motion used at a trot is likely to show no sign of lameness.