

Effect of passive stretching on the range of motion of osteoarthritic joints in 10 labrador retrievers

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Ten labrador retrievers and their owners undertook a programme to determine the effect of passive stretching on the dogs' osteoarthritic joints, which had a restricted range of motion. The range of motion of the joints was measured before and after the 21-day study, during which the owners performed 10 passive stretches for a hold of 10 seconds twice daily. Goniometric measurements showed that the passive stretching had significantly increased the range of motion of the joints.

OSTEOARTHRITIS is the most common form of joint disease affecting dogs (Bennett and May 1995) and is estimated to affect 20 per cent of dogs over one year of age (Anon 1996). There is no known cure, and the prevalence of the disease is likely to increase as dogs enjoy a greater life expectancy (Bennett and May 1995).

Animals with osteoarthritis tend to reduce their activity levels, a change that tends to decrease the flexibility and increase the stiffness of their joints (Millis and Levine 1997). The clinical signs include pain and disability. The reduced range of movement of the affected joints may be a direct consequence of pain, because reducing joint motion helps to decrease nociceptive activity (Johnston 1997). However, this reduction in movement predisposes the joint to the formation of capsular adhesions and shortened ligaments, which, together with osteophytes, lead to a reduction in the flexibility of the joint (Herzenberg and others 1994, Halbertsma and others 1996). The pain and disability thus set up a feedback loop in osteoarthritic joints. The joint pain leads to a reduction in exercise tolerance, which in turn results in muscle atrophy and a reduction in soft tissue flexibility, and ultimately in reduced joint range. A reduction in the range of movement of the joints is often associated with functional disabilities, for example, when climbing the stairs, or rising from a recumbent position – particularly relevant to dogs with hip, stifle or elbow joint restrictions.

Physiotherapy has been shown to be useful in the management of osteoarthritis in human beings, reducing the severity of the symptoms and their reliance on medication to control pain (Puett and Griffin 1994). In particular, passive stretching is frequently used as means of increasing the range of motion of the joints (De Deyne 2001). For the purposes of this study, 'passive stretching' is defined as a method of applying an external force to a relaxed dog, to lengthen pathologically shortened soft tissue structures.

Studies in people have shown that passive stretching and exercise can improve the function of restricted joints (Kerrigan and others 2003, Malliaropoulos and others 2004), but their effects in animals are not well documented. The aim of this study was to determine the effect of passive stretching on osteoarthritic joints with restricted motion in 10 dogs. It was hypothesised that passive stretching would increase the range of motion in the joints whose flexibility had been reduced by osteoarthritis.

MATERIALS AND METHODS

The dogs were recruited to the study at five first-opinion veterinary practices over a period of five weeks, and their owners were offered physiotherapy treatment by their veterinary surgeon.

Inclusion and exclusion criteria

Dogs were included in the study if they were healthy labrador retrievers of either sex, more than 18 months old; they had osteoarthritis of the elbow, stifle or carpus, confirmed by clinical diagnosis and/or radiographs, which restricted the range of motion of the affected joint; and their owners were willing and able to comply with the study procedures, and willing to give written informed consent for their dog's participation.

Dogs were excluded if they were in severe pain due to osteoarthritis, if they had a musculoskeletal disorder other than osteoarthritis, if they were receiving long-term corticosteroid therapy, or if their owner had a history of non-compliance.

Four bitches and six dogs were recruited, with a mean age of 7.5 years (range 18 months to 13 years). Each dog served as its own control, and treatment with non-steroidal anti-inflammatory drugs, nutritional supplements and exercise levels were kept constant throughout the study.

The range of motion of the affected joint was measured on day 1, with a 12-inch goniometer (Catalogue number 337; Zimmer Orthopaedic). Each dog was placed in lateral recumbency, with the affected joint uppermost, and controlled and comforted by its owner or handler. The centre of the goniometer was positioned over the axis of rotation of the joint and its arms were aligned with predetermined anatomical landmarks, as described by Jaegger and others (2002). The same operator obtained three successive measurements of the range of movement of the joint, and the mean value of these measurements was calculated. The reliability of the operator's goniometric measurement had been determined in a previous study in which it had been found that the range of movement could be measured to within 4° (Crook 2001).

The dog's owner was instructed how to stretch the affected joint passively by a veterinary physiotherapist, by explanation, demonstration and supervised practice. The degree of force to be applied was demonstrated by passively extending the owner's first finger into full extension of the interphalangeal joints, and by applying force until a restriction was felt at the end of range. The owner was instructed that the stretch should not cause discomfort or distress to the dog. The owner was asked to perform the stretch in full flexion and in full extension, holding for a count of 10 seconds at the end of range, and repeating the procedure 10 times twice daily, once in the morning and once in the evening, for 21 consecutive days. Written instructions on the aim of the study, the stretching technique and a contact number in cases of difficulty were given to the owners on day 1, and they were given a record form, which contained a checklist for them to record the completion of the morning and evening sessions.

After the 21-day stretching programme, the range of movement of the joints was measured again by the same method as on day 1.

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TABLE 1: Changes in the range of movement of appendicular joints of eight labrador retrievers with clinical osteoarthritis after the application of a programme of passive stretching

Dog	Joint	Range of joint movement (°)			
		Before	After	Change	Difference (%)
1	R Elbow	115	123	8	7
2	R Stifle	139	151	12	9
3	L Elbow	141	157	16	11
4	R Elbow	136	152	16	12
5	L Elbow	124	136	12	10
6	R Stifle	117	132	15	13
7	R Elbow	145	156	11	8
8	R Elbow	116	143	27	23

R Right, L Left

Statistical analysis

The paired *t* test was used to analyse differences between the range of movement of the joints before and after the programme of passive stretching. For all comparisons, the differences were considered to be significant at values of $P < 0.05$.

RESULTS

Eight of the 10 dogs completed the 21-day stretching programme; one was withdrawn owing to abdominal surgery, and one was withdrawn because its owner believed that it was in too much discomfort during the procedure. None of the other owners reported that their dogs experienced any discomfort.

There was a significant increase in the range of motion of the joints in all the dogs after the 21-day stretching programme ($P < 0.0005$) (Table 1). There was a mean angular increase in joint flexion of 14.6° (95 per cent confidence interval 10.7 to 18.5°).

The percentage increase in the range of motion ranged from 7 to 23 per cent.

DISCUSSION

The results show that passive stretching can effectively increase the range of movement of the osteoarthritic joints of labrador retrievers. Because it was not possible to estimate the standard deviation of the differences in the range of movement of the joints before and after the programme of passive stretching, a retrospective calculation of power and sample size was made. This confirmed that only five pairs of measurements would have been required to detect, with 80 per cent power, an increase of 10° in range of motion, at the 5 per cent level of significance, assuming that the standard deviation of the differences was 5.7° . This calculation confirmed that the results of the study were statistically robust.

Labrador retrievers were chosen as the experimental subjects because the breed has a predisposition to several primary and bilateral joint diseases that cause secondary osteoarthritis (Olsewski and others 1983, Padgett and others 1995). Many other breeds are known to be similarly affected by primary joint pathologies, such as hip and elbow dysplasia, and cruciate ligament pathology, which ultimately result in secondary osteoarthritis (Lavelle 1994), and so the results of this study should readily be extrapolated to other breeds.

The use of dogs of a single breed, each of which served as its own control, increased the homogeneity of the group and minimised the effects of differences in conformation, age, sex, weight and fitness levels. However, this 'before and after' design could be criticised for encouraging the owners' responses to be biased (a placebo effect), but the alternative

of treatment and control groups could have been confounded by the difficulty of finding groups of dogs with similar levels of arthritic disease.

All the dogs had a limited range of movement in one or more joints, and had been diagnosed clinically as having osteoarthritis, but it was not possible to determine the exact anatomical pathology responsible for the reduction in joint movement. Furthermore, determining the severity of the joint disease is notoriously difficult, although several methods have been proposed. 'Radiographic severity ratings' have been used in an attempt to overcome this problem (Deyle and others 2000); however, a joint may show marked radiographic changes associated with osteoarthritis, such as joint space narrowing and osteophyte formation, but the dog may be relatively free of clinical signs (Hardingham and others 1991). Conversely, in the early stages of the disease, an acutely inflamed joint may be painful and its movement may be restricted, but it can appear radiographically normal. It was difficult to determine the homogeneity of the cases included in the study because they were selected by different veterinarians who would have depended on their own interpretation of the clinical findings and/or radiographs. The variations in the osteoarthritic pathology were probably responsible for the variation in the range of movement of the same joint in different dogs, and may also explain the varied responses to the treatment.

Goniometry was used to measure the range of movement of the joints. Other methods are available, including radiography and cinematography, but they can be expensive, labour-intensive and are not always practical in a clinical setting. Goniometry remains one of the most commonly used techniques in orthopaedic and physiotherapy practice (Jaegger and others 2002, Doran 2003). It had previously been shown that the operator could reliably measure the range of movement of the joints with the goniometer to within 4° , a finding comparable to human studies (LaStayo and Wheeler 1994, Brosseau and others 2001); it can therefore be assumed that an increase in joint flexibility of more than 4° after the programme of passive stretching was due to physiological change rather than experimental error. The range of movement of the joints increased by between 8° and 27° .

It could be argued that pain and the conscious state of the dog would have affected the goniometric measurements. The dogs may have been apprehensive and less compliant at the initial measurement, owing to the unfamiliarity of the procedure, and their joints may thus have been less flexible; they may have been more relaxed for the second measurement after the programme of stretching. Their anxiety and pain could have been reduced by sedation. However, a study of the effects of sedation on dogs with pain-free joints found no significant difference between the range of motion of the joints in the sedated or unsedated dogs (Jaegger and others 2002). If pain is elicited, the conscious animal may actively resist the motion of a joint. Because the dogs were conscious during the goniometric measurements it could be argued that the stretching procedure had resulted in a decrease in pain, and hence a greater range of movement.

This study relied on the owners to carry out the programme of stretching. The effectiveness of the technique was therefore dependent on the owner's willingness to perform the stretching as instructed. Every effort was made to ensure that each owner applied a similar degree of force, but it cannot be assumed that this was the case. The fact that some of the dogs improved more than others may therefore have been because their owners stretched their joints more forcibly or for longer.

Each stretch was held for a period of 10 seconds, on the basis of the work of Borms and others (1987), which showed that holding for a period of 10 seconds was sufficient to improve the flexibility of the hip joint in human beings.

As with many forms of therapy, the quality of the outcome depends directly on the compliance of the animal and its owner. If passive stretching is to be used as a method for increasing the range of motion of the joints of pet animals, the owners must be willing to perform the stretches consistently and regularly, because cost and time preclude frequent interventions on the part of the veterinarian physiotherapist. This study involved animals with established chronic osteoarthritis and a loss of range of motion in their joints; such animals are often treated effectively by weight control and programmes of exercise, but passive stretching could complement these techniques.

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