Select Manual Assessment Techniques and Clinical Reasoning Skills Used in Canine Physical Rehabilitation Before Engaging in Manual Therapy Treatment

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KEYWORDS

• Clinical reasoning • Manual therapy • Physical therapy • Chiropractic • Osteopathy
• Functional diagnosis • Canine rehabilitation • Physical examination

KEY POINTS

- Clinical reasoning skills are fundamental in canine physical rehabilitation as a method of making sense of all data collected during an examination and formulating a functional diagnosis.
- Observation skills allow analysis of posture and movement patterns that further guide the direction of the physical examination.
- Manual assessment skills consider selective tissue tension techniques, end feels, and palpation findings.
- The culmination of clinical reasoning, observations, and manual assessment techniques can serve to direct the treatment plan including what, where, when, and how manual therapy should be performed to help achieve the rehabilitation goals.

INTRODUCTION

Manual therapy is a cornerstone of treatment in physical therapy and canine physical rehabilitation. Its effectiveness has been validated and mechanisms of action expanded upon within the last decade.[1,2] Of equal importance, however, is the determination of

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Vet Clin Small Anim ■ (2023) ■–■
https://doi.org/10.1016/j.cvsm.2023.02.007 **vetsmall.theclinics.com**

when manual therapy techniques should be used to achieve a desired goal or outcome. Current veterinary literature is lacking in regards to the manual assessment techniques that guide manual therapy interventions.

First, the goals of the animal owner need to be established to ensure they are realistic. The next step is to assess the patient through use of clinical reasoning skills and a comprehensive masterful manual assessment. This article will discuss how to use clinical reasoning skills and a select grouping of assessment techniques that will help the clinician arrive at a functional diagnosis in order to guide a treatment plan that includes manual therapies.

Clinical Reasoning

Clinical reasoning has been defined as a process in which the clinician interacts with the patient (or in the veterinary setting, the owner), and structures meaning, goals and health management strategies based on scientific evidence, clinical data, patient/owner choices and professional judgment and knowledge.[1]

The process of clinical reasoning is interactive and dynamic and can lead to a functional diagnosis, differential diagnoses, and/or a clinical hypothesis. The aim is to identify all causal and correlative factors and subsequently prioritize treatment approaches. This process is not an alternative to traditional diagnostics but it is helpful in determining what, if any, further diagnostics are indicated. Additionally, consideration needs to be given to the fact that rarely in animal rehabilitation is there a singular diagnosis for all that is affecting the animal patient. There are often additional or secondary dysfunctions related to, causal to, or affected by the primary "diagnosis," which are likely to require additional remediation efforts.

The aim of the functional diagnosis is to diagnose movement system impairments to guide intervention for health optimization such that the disability can be minimized.[3] The key diagnostic questions addressed are as follows: (1) What are the impairments, their nature and source? (2) Which impairments are related to the patient's functional limitation? (3) Which among these can be remedied by intervention? (4) What is the influence of the contextual (environment and individual) factor of a patient in his function? (5) Can the contextual factors be changed or remedied to maximize performance? (6) What is the diagnostic label? Although the medical diagnosis might identify the structure at the root of the issue, it is insufficient to guide a comprehensive rehabilitation strategy. As such rehabilitation practitioners use their own functional diagnoses to proceed with manual therapies or other treatments.

In animal rehabilitation, the process of clinical reasoning should consider signalment, breed predisposition, and progression of clinical signs over time with or without treatment. Bayesian probability is an interpretation of the concept of probability, in which, instead of frequency or propensity of some phenomenon, probability is interpreted as a reasonable expectation representing a state of knowledge or as quantification of a personal belief.4 A recent article reinvigorated the concept of Bayesian clinical reasoning in application to the diagnosis of an intervertebral disc extrusion in a chondrodystrophic dog.[5] "Bayesian clinical reasoning is a way of taking into account the known pretest probability of a disorder (based on a mix of published reviews, studies and case reports, and expert opinion), and using this information to interpret the probability of that disorder following the results of a diagnostic test."[5] For example, acute pancreatitis is known to present with vague, nonspecific signs including pain alone in the cranial abdominal region, which can commonly be misdiagnosed in cases of intervertebral disc extrusion, and vice versa.[6] However, clinical experience tells us that a 5-year-old dachshund will most likely have a disc extrusion, whereas a middle-aged miniature schnauzer is more likely to have pancreatitis.

Clinical progression, response to treatment, combined with signalment can almost be considered a "test," which will not only meet many of the criteria previously described but also lead to many dogs recovering without the requirement for further testing.[5]

A variety of components are considered when a practitioner engages in clinical reasoning as part of the assessment process. **Table 1** has been modified to fit the canine model and addresses contexts and metaskills of clinical reasoning.[7]

The skills required to guide orthopedic manual physical therapy have been established by consensus.[8] They include the ability to accurately and efficiently select inquiry strategies based on early recognition and correct interpretation of relevant clinical cues; the ability to reflect and self-evaluate in managing patients; knowledge of the specific special tests/screening tests for the safe practice of orthopedic manual therapy; creativity and innovation in the application of knowledge of orthopedic manual physical therapy; knowledge of effectiveness, risks, and efficacy of orthopedic manual therapy interventions; knowledge of the specific diagnostic and evaluative qualities of assessment tools; knowledge of prognostic, risk, and predictive factors of relevant problems and their impact on orthopedic manual therapy management strategies; the ability to identify the nature and extent of patient's functional abilities, pain, and multidimensional needs; the ability to determine which assessment and intervention tools are most appropriate; the ability to interpret outcomes of assessment and interventions; and the ability to accurately predict expected changes and progress toward realistic outcomes. The skilled canine manual therapy practitioner needs to be equally cognizant and trained in these areas.

For the purpose of this publication, the authors will focus on visual assessment of gait and posture, and the manual assessment techniques of selective tissue tension (STT), end feels, and palpation because they factor into clinical reasoning processes and the formation of a functional diagnosis. The culmination of all components is what effectively guides treatment through manual therapy interventions.

Observation of Movement and Posture

Jiandani and Mhatre (2018) state that the aim of a physical therapy diagnosis or functional diagnosis is to diagnose movement system impairments to guide intervention

Table 1
Contexts and metaskills of clinical reasoning in canine rehabilitation

Contexts	
Practitioner	Patient
• Practice knowledge	• Preexisting medical conditions/comorbidities
• Practice experience	• Breed conformation
• Values and beliefs	• Progression of clinical signs (with or without treatment)
• Own professional practice	
Owner	• Job
• Home environment	
• Goals of patient	
Metaskills	
• Knowledge of animal behavior	
• Understanding of canine body language	
• Understanding of breed disposition	
• Analytic skills and pattern recognition	

Adapted from: Higgs J, Jones M. Clinical reasoning in the health professions. In: Higgs J, Jones M, Loftus S, et al., editors. Clinical reasoning in the health professions. Edinburgh: Butterworth Heinemann; 2008. p. 24.

for health optimization such that the disability can be minimized.[3] As such, the observational portion of the assessment detects movement impairments associated with the underlying pathology, which can then be further investigated during the subjective history and manual evaluation.

Observational skills are an expertise unto themselves. Via observation of informal movements about the examination room as well as a formal gait analysis, the rehab practitioner takes note not only of lameness or off-loading of a limb but also of head position, tail position, thoracic and pelvic limb placement, structure, asymmetries, muscling, stride length, weight-bearing, spinal position and movement, and hair anomalies, and so forth. Even at this early stage, the experienced practitioner can start formulating a plan for their physical examination.

These same observations will take place as you look at posture in standing, sitting, and lying. Transitions will be equally important to note as well, along with 3-legged standing for balance and strength. One should then formally look for conformational abnormalities, head position, thoracic and pelvic limb placement, structure, asymmetries, muscling, weight distribution, and hair anomalies. Additionally, spinal position, such as sway, roaching, curvature; pelvic position; and tail position should be noticed. It is beyond the scope of this article to identify every possible gait deviation but to highlight selected observations seen during gait and posture with certain diagnosis.

Posture and Balance

The practitioner should have knowledge of typical weight-bearing patterns in normal dogs and those with orthopedic or neurological conditions. This will provide information that may be valuable in the rehabilitation of the canine patient. Posture is generally evaluated first, and any deviations from normal can be observed and then further confirmed in movement analysis. Conformation is also a factor to consider when evaluating posture. Conformational faults alone can predispose structures to abnormal stresses that could result in injury.[9]

For example, a dog may be shifting its weight off the affected limb, and one would observe that compensations may occur in a contralateral limb or diagonal limb. Further observation may reveal that the paw of a compensating limb may be splayed due to increased weight-bearing and a spinal sway away from the affected limb with thoracic spine roaching (if the lame limb is the forelimb) or lumbar/pelvic flexion (if the affected limb is in the rear). Static balance should also be a part of the postural examination (ie, 3-legged stand, and transitional movements.)

Movement Analysis

Mondino and colleagues[10] (2022) and Lasceles and colleagues[11] (2006) determined that pressure-sensitive walkway systems and force plates are a reliable tool to evaluate gait in dogs. However, many clinics do not have these types of gait analysis tools. Therefore, observational skills and clinical reasoning direct the practitioner toward the areas requiring further physical evaluation.

When observing gait, it is best to use symmetric gaits, such as the walk and trot. Lameness scores can be used as an assessment tool within the clinic.[9,12] However, lameness scores do not describe gait abnormalities. Key factors to observe are stride length, stance phase, weight-bearing, thoracic and pelvic limb placement and carriage, head position, ataxia, spinal position, or asymmetries. It has been noted that severe lesions may cause overt lameness, whereas, a lesser lesion may produce a weight-bearing lameness or gait alteration.[9] Both scenarios cause the dog to alter their gait subsequently causing compensatory weight shifts that affect other parts of the quadruped's body. For example, if the right elbow is involved the contralateral limb

will be impacted due to the increased weight-bearing on that limb. This shift in weight then can affect the lower cervical spine, upper thoracic spine, left shoulder and the diagonal pelvic limb, which then can affect the lumbar spine, and pelvis depending on the chronicity of the injury.

Cranial Cruciate Ligament Disease

After cranial cruciate ligament rupture (CCLR), peak vertical force may be only 50% of normal at a walk, and dogs may be non–weight-bearing at a trot.[13] Initially, weight-bearing is increased onto the contralateral rear limb,[13,14] likely from the compensation of the affected limb. It has been found in many kinematic studies that dogs with CCLR demonstrate altered movement in the coxofemoral, femorotibial, and tarsal joints.[14–16] The femorotibial joint angle in the cruciate-deficient state was more flexed throughout the stance and early swing phase of stride and failed to extend fully in the late stance, when limb propulsion is typically developed. The coxofemoral joints in contrast were extended more during the stance phase, perhaps due to compensatory changes.[12] This pattern of CCLR pathological gait provides valuable objective information that can guide the physical examination and subsequent rehabilitation treatment.

Hip Dysplasia

Clinical observations of dogs with hip dysplasia include exercise intolerance, stiffness on rising, bunny hopping, a narrow-based stance, a side-to-side or waddle-like gait, circumduction, shuffling feet, and signs of joint pain with passive range of motion (PROM) and lameness. The degree of lameness is variable and may be mild or severe, and some affected dogs may not be lame.[17] Poy and colleagues[17] (2000) found that dogs with hip dysplasia had a greater degree of coxofemoral joint adduction and range of abduction-adduction and greater lateral pelvic movement. These findings were derived through kinematic studies; however, visual observation of the same can be noted in a clinical examination. Postural deviations commonly include increased weight-bearing onto the contralateral rear and diagonal thoracic limb, narrow-based stance in the rear (affected limb may be slightly held cranially and adducted) and increased lumbar flexion.

Elbow Osteoarthritis

Elbow osteoarthritis is a deterioration of the joint usually secondary to joint incongruity, instability, or some other disruption of the articular cartilage. Bockstahler and colleagues (2009) showed that during posture the load was reduced on the affected limb and increased on the contralateral forelimb and the diagonal hind limb, which resulted in a more balanced weight distribution. During gait analysis, in this same study, the weight redistribution was seen primarily to the contralateral hind limb. These results suggested that forelimb lameness could lead to overload on nonaffected extremities and the vertebral spine.[18] Observing these postural shifts can guide the clinician toward areas that may need further manual evaluation to detect secondary areas of concern.

Intervertebral Disk Disease

Intervertebral disk disease (IVDD) can affect the cervical, thoracic, and lumbar spine. Common presentations in posture and gait can vary depending on the location and severity of the lesion. Neck pain is common in cervical IVDD and may often be the only sign.[9] In these cases, head carriage is low during stance and gait, and there may be short “stutter” stepping gait in the thoracic limbs. Thoracolumbar IVDD is the most common form of disc disease, it accounts for 66% to 86% of all cases.[19]

It has been noted that dogs with acute thoracolumbar IVDD managed surgically tend to lean forward during their recovery period.[20] This is likely in response to ongoing pelvic limb weakness and possible lack of or decrease in proprioception. Lumbosacral disc disease or cauda equina syndrome is in general terms describing compression, inflammation, or vascular compromise of the nerve roots of the cauda equina. Presentation in stance commonly reveals a roaching of the caudal spine (**Fig. 1**), weight distribution cranially, and skin lesions (lick granulomas) on the tail, genitals, or extremities.[19] Gait abnormalities can display as rear limb ataxia, lameness due to radiculopathy, pelvic limb knuckling or nail scuffing, lumbar flexion, and abnormal tail carriage.

Keen observation is often the first-assessment tool utilized by the animal rehabilitation practitioner. Information garnered during this part of the assessment can direct the clinician to areas of primary and secondary concern, to be further evaluated and confirmed with manual techniques during the physical examination.

The Physical Examination

Once the history has been noted and posture and gait have been analyzed, the skilled rehab practitioner proceeds with a physical examination. Directing their focus on either the spinal joints or the peripheral joints based on the information garnered and following a systematic approach that helps to guide and direct the specific physical tests required to establish a functional diagnosis (**Fig. 2**). In almost every case, a scan of both the spine and the peripheral joints is conducted in order to rule in or rule out the spine as a source of clinical signs and/or to identify additional structures that could be compounding the clinical picture. It is outside the scope of this article to fully describe each test for each joint. As such, selected testing practices will be described below.

Selective Tissue Tension

Dr James Cyriax originally described a systematic approach to physical assessment that has been internationally taught and adopted by orthopedic manual practitioners in a multitude of medical fields.[21,22] One such testing method is that of STT techniques.

The premise behind STT is that a healthy structure functions painlessly; a faulty structure does not. As such, each tissue from which pain could originate is assessed in turn, and as each structure has a known and separate function, the tissue that

Fig. 1. Example of the common postural presentation of lumbosacral disc disease.

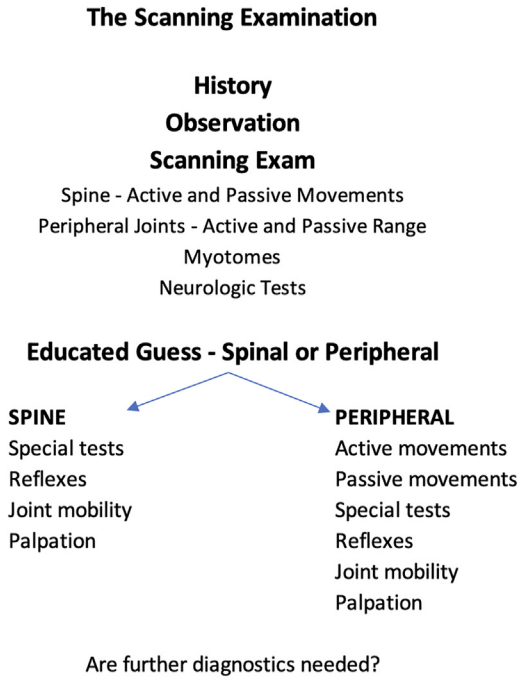

Fig. 2. A typical scanning examination used to rule in or rule out spinal or peripheral structures as primary or secondary components in the clinical picture.

cannot function without pain is at fault. The mechanism of diagnosis is manually applied tension, and each tissue around a joint is subjected to tension systematically. A standardized STT assessment typically considers active movement, passive movement, and resisted tests.[23] Human studies have demonstrated the Cyriax method of STT testing to provide adequate results, especially for shoulder pathologic conditions where soft tissue structures are common pathologic conditions.[24–26]

During active movements the examiner can observe the following: when and where during each of the movements the onset of pain occurs; whether the movement increases the intensity and quality of the pain; the reaction of the patient to pain; the amount of observable restriction and its nature; the pattern of movement; the rhythm and quality of movement; the movement of associated joints; and the willingness of the patient to move the part.[23] In the canine patient, active movements are best observed while watching a dog gait and observing not only which limb is unsound but also how the animal is moving and compensating. Observation of other tasks or asking questions pertaining to functional abilities (ie, how the animal ascends or descends stairs, sits, gets up from lying, turns, and so forth) may be useful to gather information about active movements and avoidance.

Passive movements provide the animal practitioner with the potential for greater information. PROM should be conducted with the patient as relaxed as possible. Goniometry may be useful for measuring and recording joint deformities and can prove as a useful tool for gauging differences from side to side or alterations of PROM.[23] Goniometry has been studied and found to be reliable in canine applications[27,28]; however, a joint angle number does not convey a functional diagnosis. Of greater diagnostic importance are the examiner observations during passive movement: when and where

during each of the movements the pain begins, whether the movement increases the pain, the pattern of limitation of movement, the end feel of movement, the movement of associated joints, and the range of motion available.[23]

Resisted movements are often key to the detection of contractive structures in human patients. This type of movement consists of a strong, static (isometric), voluntary muscle contraction and is used primarily to determine whether the contractile tissue is the tissue at fault, although the nerve supplying the muscle is also tested.[23] The examiner observations during resisted tests would include the following: whether the contraction causes pain and, if it does, the intensity (or quality) of the pain; strength of the contraction; and the type of contraction causing the problem (ie, concentric, eccentric, isometric). Resisted movements are much easier to test in a human patient than an animal patient. However, there may be times when a soft tissue is put on stretch and a practitioner holds the limb in place because the animal fights the hold in an attempt to reposition the limb. Thus, a resisted movement could be evaluated in a canine patient.

Examination example for selective tissue tension testing

When confronted with a canine patient with a suspected supraspinatus tendon pathology, the examiner may find that the animal is demonstrating a lameness when weight-bearing on the affected limb. The canine patient might also lack active shoulder extension during the terminal swing phase of the limb as compared with the contralateral limb. Passive shoulder extension would be full and unremarkable. Shoulder flexion, however, could be painful at end range, where the supraspinatus muscle and tendon are on full stretch. In this scenario, the examiner could pinch a toe with the shoulder in flexion, in an attempt to get the dog to resist his shoulder being held in this position. Pain on resisted contraction of the supraspinatus muscle could lead the examiner toward ruling in supraspinatus as a differential diagnosis. Further testing would ensue whereby other adjacent soft tissue structures where stretched (and resisted), the end feel of the shoulder joint in all ranges would be considered, and palpation of the suspected structures conducted. A culmination of findings could help the practitioner to formulate a working physical diagnosis.

End Feels

End feel to a movement is an important diagnostic indicator. It is the detectable sensation as noted by the examiner's hands at the extreme of a passive movement.[22] The end range of movement is stopped by a variety of structures. Each structure has a different sensation when stressed. Each joint has a different structure that stops motion in any given direction. For example, elbow extension is accompanied by a "Bone to Bone" end feel. This is normal. However, a "bone to bone" end feel would be characterized as abnormal for elbow flexion and could be the result of osteophyte formation and/or osteoarthritis. Those in veterinary medicine that are unfamiliar with the concept of end feels can however likely relate to the physical sensation of testing for cruciate deficiency and noting that a fully torn cranial cruciate ligament presents with a drawer sign that has a distinctly different stopping end feel than that of a fully intact cruciate ligament. **Table 2** is a modification of Cyriax's original listing of end feels.[29] It shows a list of normal and abnormal end feels. It is also possible to have an end feel that is normal for any given joint and movement but that comes on too early in the range.

Utilization of end feels as part of the physical examination has been studied in human medicine. Taken on their own, interrater reliability is variable for determination of an end feel; however, improvements in reliability are noted when consideration is

Table 2
End feels

End Feel	Description	Impression	Normal	Abnormal
Capsular–hard and soft	Produced by capsule or ligament. The end sensation has varying degrees of stretch (depending on the thickness of the capsule or ligaments)	It feels as if further force could tear something	Stifle extension (hard capsular)	Early arthritic changes in a joint can yield a hard capsular end feel before full normal joint range
Bony	An abrupt end to movement, produced by bone on bone approximation	It feels as if further force could break something	Elbow extension	Severe degenerative joint disease affecting ROM in any joint
Elastic	Produced by a muscle-tendon unit. Often occurring with adaptive shortening. A hard feel to the end of movement but with a stretch and elastic recoil effect	It feels as if further force could cause something to snap	Flexion of the tarsus	As with a soft tissue contracture impeding either flexion or extension of any extremity joint
Springy	Produced by the articular surface rebounding from an intra-articular disc or meniscus	It feels as if further force could collapse it	Axial compression of the human cervical spine	As with a soft tissue contracture impeding either flexion or extension of any extremity joint
Soft tissue apposition	Produced by 2 muscle bulks coming in contact with one another. Motion is stopped by impedance of soft tissues	It feels as if more motion could be obtained of you could apply more force	Stifle flexion	As with full flexion or extension of the stifle in the presence of a meniscal lesion
Boggy	Produced by viscous fluid (eg, blood)	It feel as if	Never normal	As per description–blood in a joint
Spasm	Produced by a reflexive and reactive muscle contraction in response to irritation of the nociceptors predominantly in articular structures or muscles	It feels as if further force could damage blood vessels	Never normal	As with stifle extension in the case of an acute CCL tear
Empty	Lack of an end feel entirely. No tissue resistance is detected	Nothing. The patient cannot tolerate more ROM dude to pain	Never normal. Usually indicative of a serious pathologic condition	As in the case of an intra-articular fracture, tumor or cyst

Modified from Magee DJ, Zachazewski JE, Quillen WS. Scientific Foundations and Principles of Practice in Musculoskeletal Rehabilitation. Saunders Elsevier, St Louis, 2007.

given to additional tests or factors (such as pain) and noting of changes or differences (ie, from side to side).[30–33] Petersen and Hayes (2000) reported that the presence of pain is more associated with abnormal-pathological end feels than the normal end feels in shoulder and knees of human patients.[34] This finding was also noted in another study that evaluated the cervical spine[35] where combining the assessment of pain provocation and asymmetry of passive intervertebral mobility testing yielded favorable interrater reliability. A biomechanical study also concluded that in elderly patients with unilateral chronic low back pain, muscle tone, and stiffness of paravertebral muscles on the painful side are higher than for those on the nonpainful side.[36] Accurate detection of end feels seems to improve with clinician experience. Kawamura and colleagues,[37] in 2020, utilized an end feel simulator to determine that years of clinical experience and conscious effort to perceive end feels yielded a higher proportion of correct answers compared with less experienced clinicians. Taken as a composite, asymmetry of biomechanical properties, pain, and the evaluation of multiple factors should be noted by clinicians as part of the physical examination in order to adequately interpret end feels and their relevance.

Palpation

In addition to using palpation to determine end feels and stiffness of a joint, palpation to determine muscle symmetry as well as lowered pain threshold is common practice in both human and animal medicine. Palpation is considered to be a key outcome measure and assessment tool for equine rehabilitation professionals.[38] Manual palpation by veterinary physiotherapists has been shown to have excellent interrater reliability when using a categorical scoring system for the determination of mechanical nociception threshold responses for back pain in horses.[39] Back pain in horses can be differentiated by severity of pain response to back palpation, back muscle hypertonicity, and thoracolumbar joint stiffness.[40]

A palpation scale was used in the Merrifield-Jones and colleagues[39] (2019) study that was modified from an earlier scale utilized in a study by Varcoe-Cock and colleagues (2006)[41] (**Table 3**). A similar scale or study that evaluated palpation scoring in dogs could not be found on review of available literature.

Beyond palpation for muscle tone, palpation can also detect pain in other soft tissue structures such as tendons or ligaments. Focal tenderness on palpation of tendons is

Table 3
Manual palpation scale for equine practice

Score	Description
0	Soft, low tone
1	Normal
2	Increased muscle tone but not painful
3	Increased muscle tone and/or painful (slight associated spasm on palpation, no associated movement)
4	Painful (associated spasm on palpation with associated local movement, ie, pelvic tilt, extension response)
5	Very painful (spasm plus behaviour response to palpation, ie, ears flat back, kicking)

With permission from: Merrifield-Jones M, Tabor G, Williams J. Inter- and Intra-Rater Reliability of Soft Tissue Palpation Scoring in the Equine Thoracic Epaxial Region. J Equine Vet Sci. 2019 Dec;83:102812.

a common finding in tendon lesions, and sprained ligaments in both human and veterinary practice.[42–45] Combined with other clinical findings, pain on palpation contributes to the reliability of a physical diagnosis.[46]

SUMMARY

Manual treatment will be determined after a thorough neuromusculoskeletal assessment by a qualified practitioner. This will include using many skills including clinical reasoning, thorough observational assessment, and manual evaluation. When putting all the gathered information together, it should guide the manual therapy treatment plans. The skills discussed in this article are foundational stepping stones for practitioners when determining when, where, how, and which manual therapies to use as treatment techniques in canine rehabilitation.

DISCLOSURE

The authors have no commercial or financial interests to disclose.

DECLARATION OF INTERESTS

None.

CLINICS CARE POINTS

- Manual therapy treatments should not be provided without a skilled evaluation of the animal and its specific tissues.
- Advanced training is required to acquire manual assessment and treatment skills.
- Bayesian clinical reasoning further enables accurate interpretation of assessment finding.

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