Clinical exam protocol for the equine thoracolumbar spine

Protocolo de exame físico para a coluna toracolombar de equinos

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Abstract

Thoracolumbar injuries represent a challenge to the veterinarian that seeks to eliminate the pain, reinstitute the athletic use of the horse and minimize economic losses. The percentage of lost training days due to orthopedic conditions in race horses is of 72.1% and within those conditions is back pain, whicht represents from 4.35% to 20% of the lameness cases. The present study searched to establish a protocol based on score points for the thoracolumbar physical exam, by which it is able to determine the possible affected areas and the seriousness of the injuries. Along with the physical exam, it was performed an ultrasonographic exam of the thoracolumbar region to characterize and classify the injuries found, as to accompany its evolution after treatment. It was observed a clear reduction in the physical exam score sum in all animals between the exam days being that the exam of most of the animals presented a zero score at 60 days after the treatment. Relating the evolution of the clinical exam with the ultrasonography image tests, there was a positive association between the reduction score in the severity scale and the evolution of the ultrasonographic image of the evaluated structures. Thus, it can be concluded that gradation of the physical exam showed to be efficient and allowed the monitoring of the clinical evolution, as the answer of the injuries to the suggested treatment. Besides that, the results showed that 60 days is the ideal time for the first reevaluation of the animal after the treatment.

Keywords: Back Pain. Clinical exam. Spine. Ultrasonography.

Resumo

As enfermidades toracolombares representam um desafio ao veterinário, que busca eliminar a dor, restituir o uso atlético do cavalo e minimizar perdas econômicas. A porcentagem de dias de treino perdidos devido a afecções ortopédicas em cavalos de corrida é de 72,1% e dentro destas afecções estão as lombalgias, que representam de 4,35% a 20% dos casos de claudicação. O presente estudo procurou estabelecer um protocolo baseado em pontuação por escores para o exame físico da região toracolombar, por meio do qual se consiga determinar as possíveis regiões afetadas e a gravidade das lesões. Juntamente com o exame físico, foi realizada a ultrassonografia da região toracolombar, para caracterizar e classificar as lesões encontradas, assim como acompanhar sua evolução após o tratamento. Foi observada uma evidente redução na soma dos escores do exame físico em todos os animais entre os dias de exame, sendo que o exame da maioria dos animais apresentou escore zero aos 60 dias após o tratamento. Relacionando a evolução do exame clínico com os escores ultrassonográficos houve associação positiva entre a redução do escore na escala de severidade e a evolução da aparência ultrassonográfica das estruturas avaliadas. Sendo assim, pôde-se concluir que a gradação do exame físico se mostrou eficiente e permitiu o acompanhamento da evolução clínica, assim como da resposta das enfermidades ao tratamento proposto. Além disso, os resultados mostraram que 60 dias é o tempo ideal para a primeira reavaliação do animal após a realização do tratamento.

Palavras-chave: Coluna. Lombalgia. Ultrassonografia.

Introduction

Trainers, owners and riders are involved in a constant search to improve the performance of their athlete horses and to obtain important results in competitions. Unfortunately for many, this means winning at any costs, harming the life of these animals. The percentage of wastage days due to orthopedic affections is 72.1% in race horses in England[1], and within these conditions is back pain, that represents from 4.35%[2] to 20%[3] of the lameness cases.

Thus, thoracolumbar disorders represent a challenge to the veterinarian, that seeks to promote pain

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relieve, reinstitute the athletic use of the horse and minimize economic losses. Thus, an increasing interest in the correct back pain diagnosis is noted, therefore resulting in better treatments, reducing the period of wastage.

Papers about the clinical exam in horses that suffered from back pain[4,5,6,7] were published, which is really a key step of the patients evaluation to confirm the existence and place of the pain, being the diagnosis of what it is causing the pain the next step in the evaluation of an animal with signs of thoracolumbar lesion.

Once the suspicion is confirmed, the identification of what is causing the pain requires further investigation, in which the diagnosis by image techniques is essential. However, through means of physical exam we can have the precise direction of the affected place[8].

The goal of the physical exam of the spine is to identify if the back pain exists, to locate the lesion inside the divisions of the thoracolumbar region besides helping to determine if the spine dysfunction is segmental, local or regional and diffuse[5,7]. The steps of the exam are: inspection, palpation, mobility tests and movement exam.

The intensity gradation of the alterations found is in mild, moderated and severe[4]. Other qualifications can involve the use of numerical scales, in scores, with the goal of monitoring pain alterations, muscle tone, articular mobility or functional[9] alterations. Subjective parameters can be associated to scores that can be accessed pre and post treatment for comparative analysis of progression or regression of the individual parameters because the thoracolumbar disorders tend to be chronic and recurrent by nature[7,9].

Inspection: The abnormal curvatures found in equines are: lumbar kyphosis and thoracic lordosis, being that the alterations can both be found in the same animal. Detection of epaxial muscles atrophy is one of the signs of an animal with potential thoracolumbar lesions because the atrophy reflects movement reduction in areas of pain[4,5,10]. Edema areas in the saddle region or hair lost reflect bad adjustment of the animal saddle or bad positioning of the rider[4].

Palpation: Palpation is used to locate and identify texture and consistency of soft and bone tissues alterations. The layers of soft tissue is evaluated in a deep and superficial way according to the digital pressure that was applied[4,11]. Thoracolumbar palpation is made in the medium dorsal line where the supraspinal ligaments and transverse processes and the paravertebral region are examined for the epaxial[6,7] muscles evaluation. The supraspinal ligament must be systematically palpated to identify the presence of masses, fibrosis, signs of pain and areas of swelling, all its extension should be palpated over each spinous process[5,12]. Palpation of the spinous process apophysis evaluates its symmetry, alignment and presence of soreness. Typical signs of discomfort about the procedure include head and neck elevation, dorsiflexion and muscle spasms[8,13].

Epaxial muscles are palpated in search of consistency and temperature, pain or fasciculation. Each muscle, as its origins and insertions are evaluated unilaterally and then compared with the counter lateral side[8].

Mobility Tests: These tests evaluate the amplitude of the spine movement as well as the manifestation of pain during the procedure. For diagnostic purposes, the movement is graduated as decreased, normal and increased, associated or not to the fasciculation of the epaxial muscles, tail movement and escape from the exam[7,8,13]. This test principle is the application of prolonged digital pressure over points alongside the thoracolumbar region, evaluating: (1) muscle contraction, (2) induced attitude and its tolerance and (3) amplitude of the movement[6]. The evaluated movements are thoracolumbar extension, flexion, lateral flexion and rotation[6,13].

This interpretation of the tests requires prudence because while some animals respond to light digital stimulation, giving us a false positive result, others need intense stimulation to perform some movement. Thus, the examiner should consider this as-

sociated factors to the environment where the test is performed so we can have a correct interpretation of the reactions[5,14].

Movement inspection: The animal's exam to walk, trot and gallop, in a straight line – backward and forward – and in circle, can present different abnormalities. In the pattern claudication exam it can be observed the elevation of the head, pelvis symmetry, limbs positioning, arch and phases of the pace. In the thoracolumbar exam, the analysis is performed based on segment mobility as in the equine's body position during the straight line and curve movement[4,8].

Kinematic studies quantified in track the dorsoventral mobility of the thoracolumbar region of healthy equines in several gaits[15,16]. Animals with vertebral injuries showed reduction of the dorsoventral, lateral movement and rotation. This can be caused by mechanic alterations (total or partial ankylosis) or pain. Back pain can also influence in the amplitude and arch of the pace, resulting in a more rigid gait (*bunny hopping*)[5,14].

Performing the exam in different types of surfaces is also useful. The lameness coexistence in the thoracic limbs and back pain is better observed in hard surfaces and in pelvic limbs in soft surfaces[17].

Due to the inaccessibility of many anatomic structures of the spinal column that can be affected, usually it is also necessary to give up on other diagnostic techniques, such as radiology, ultrasonography and thermography, for a more accurate diagnosis of back pain in equines[18]. However, the veterinarian does not always have access to the equipment or does not know the technique to perform these steps.

Based on this fact, the present study sought to establish a protocol based on score numbers for the thoracolumbar physical exam, by which it can be determined the possible affected areas and the severity of the injuries expressed by variations on the score numbers attributed to the animals after the physical examination.

Similarly, it was evaluated the validity of this same score system in the monitoring of animals after the injuries were treated. Combined with the physical exam, an ultrasonographic exam was performed in the thoracolumbar region to characterize and classify the injuries that were found, as well as accompany the evolution after the treatment, associating the ultrasonography evolution to the score evolution in the physical examination.

Material and Method

Fourteen Quarter Horses were used, admitted at the Large Animals Surgical Service of the Faculdade de Medicina Veterinária e Zootecnia of the São Paulo State University – UNESP - Botucatu Campus complaining of low athletic performance associated with low back pain. These horses competed in three sporting modalities within western categories: reining (four animals), cutting (four animals), and barrel racing (six animals), and as a requirement for participation in the experiment, these animals should not be receiving any anti-inflammatory or analgesic medicament for at least 1 month before the first examination.

In each one of the animals a physical exam of the thoracolumbar region was performed, according to Fonseca's protocol[8], in the following sequence: inspection, palpation, mobility tests and movement exam. Followed by the physical exam, an ultrasonography was performed in all thoracolumbar regions, so that the exact location and classification of the injuries could be found.

This sequence that was used for the physical and ultrasonographic exam was performed in different moments of the exam (days 0, 30, 60, 90 and 120).

Physical Exam

The physical exam of the thoracolumbar region was performed through inspection, palpation, mobility tests and analysis of the animal in movement, according to Fonseca[8.] . After finishing the examination with notes and intensity gradation of each item of the eval-

uated parameters (Table 1) it was performed the sum of the values obtained in each parameter, as well as the sum of all parameters of the physical exam to form a total value for each animal.

Inspection: The inspection was performed with the animal being supported by all four legs, where it was observed the attitude, muscle symmetry, conformation, side view of the spine, presence of wounds in the thoracolumbar region.

Palpation: The palpation of the thoracolumbar region was performed with the animals supported by all four legs, from the first palpable thoracic vertebrae (T3 and T4) until the lumbosacral articulation. The palpation started by applying a little pressure on the anatomic structures so that the animal would remain relaxed during the exam, preventing, therefore, the muscle of the thoracolumbar region from contracting, changing the results of the procedure.

In the palpation it was observed: (1) Misalignment of the spinous processes; (2) areas with increased volume of the supraspinal ligament; (3) painful sensitivity and (4) presence of areas of spasm of the *Longissimus dorsii* muscle.

Mobility Tests: These tests were performed with the goal of getting passive movement of the spine by means of musculocutaneous stimulation, followed by the pro-

Table 1 - Scores for each item of the evaluated parameters during the physical examination of the thoracolumbar area

INSPECTION				
	NONE	**MILD**	**MODERATE**	**SEVERE**
Muscular atrophy	0	1	2	3
Scoliosis	0	1	2	3
Lordosis	0	1	2	3
Kyphosis	0	1	2	3
Muscular fasciculation	0	1	2	3
Abdominal contraction	0	1	2	3
Asymmetry of the tuber sacral	0	1	2	3
Skin lesions (saddle)	0	1	2	3
PALPATION				
Thoracic pain	0	1	2	3
Lumbar pain	0	1	2	3
Muscular spasm	0	1	2	3
Muscular fasciculation	0	1	2	3
Spinous processes out of line	0	1	2	3
Pain in the spinous processes	0	1	2	3
MOBILITY TESTS				
	NORMAL	INCREASED	DECREASED	MUSCULAR FASCICULATION
Dorsoflexion	0	1	2	2
Ventroflexion	0	1	2	2
Lateroflexion/rotation	0	1	2	2
EXAMINATION AT WORK				
		NO		YES
Lameness		0		1
Bunny hopping		0		1
Tail swishing		0		1
Contraction of the abdominal muscles		0		1
Dorsal movement of the head		0		1
Lateral movement of the head		0		1
Thoracolumbar stiffness		0		1
Pelvic stiffness		0		1
Try to get out of the circle		0		1

tocol described by Fonseca[8]. With these tests the goal was to evaluate the amplitude of the dorsal, ventral, lateral flexion and rotation movement tolerated by the animal and to search for the existence of a focus of pain in the vertebral level or injuries in paravertebrae soft tissues. It was observed the animal's reaction, identifying the presence of muscle contraction, tolerance to movement, amplitude of the movement.

Dorso and ventroflexion: This manipulation was performed by applying a bilateral digital pressure, symmetrical in both sides in specific points in the animal. Five points of pressure were used: (1) pressure in T10, observing the contraction of the *Longissimus dorsii* muscle and trapezius, cervical extension, movement of the hind limbs to cranial; (2) pressure in the T14, observing the contraction on the *Longissimus dorsii* muscle and thoracic and lumbosacral dorsiflexion; (3) pressure in the xiphoid cartilage: observing the contraction of the rectus abdominis muscle and thoracic and lumbosacral ventroflexion; (4) lumbar pressure in L4: observing the contraction of *Longissimus dorsii* muscle and thoracolumbar and lumbosacral articulations extension; (5) sacral pressure: observing the lumbosacral and thoracolumbar ventroflexion. It was considered as abnormal findings, exacerbated reaction and lack of reaction from the animals to the tests.

Lateroflexion: This test was performed to evaluate, again, the amplitude of the lateroflexion performed by the thoracolumbar spine, being performed in both sides pulling the base of the tail to the side where the examiner was, applying a counter support pressuring the fingers against the last ribs. It was considered as abnormalities the reluctance of the animal in performing the movement, amplitude of the movement decreased in one of the sides or in counter lateral spasms of the *Longissimus dorsii* muscle.

Movement exam: The evaluation of the animal at walk, trot and gallop was performed to identify the presence of pain and functional alterations such as the decreasing of vertebral mobility in some areas as detailed in Table 2. The animal was examined in a straight line and in circle movements (approximately 4 meters radius) in walk and trot in hard floor and in trot and gallop in soft floor to identify the mobility alterations.

Ultrasonographic exam

After performing a physical exam, an ultrasonographic exam was also performed, using a linear transducer of 7.5 MHz[1]. The alterations found in the supra and interspinous ligaments, epaxial muscle and articular processes were classified according to Fonseca[8].

Table 2 - Criteria for evaluating the thoracolumbar mobility in walk, trot and canter on different surfaces

SURFACE	GAIT	LEADING	OBSERVATION
Hard	Walk	Straight line Figure eight	Tuber coxae mobility Lateral flexion
	Trot	Straight line Circle	Passive DV flexibility/ Lateral flexion Lateral flexion
Soft	Trot	Círcle	Passive TL DV flexibility Hindlimb propulsion
	Canter	Círcle	Coordination and balance Hindlimb placement Hindlimb protraction/propulsion Active DV movement

DV= dorsoventral; TL= thoracolumbar. Fonte: DENOIX & DYSON, 2003.

Extracorporal Shockwave Therapy

After locating and characterizing the injuries through ultrasonography image, treatment by shockwaves[1] was performed. Three sessions were performed, with an interval of 21 days between applications, according to the protocol described by Fonseca[8].

In the post treatment period, the animals were monitored by veterinarians associated with the experiment, remaining at rest during the whole period without receiving any medication.

Results

The presence of back pain in all animals was confirmed and none presented lameness. It was observed an evident reduction in the score sum of the physical exam in all animals between days 0 (zero) and 30, 60, 90 and 120 days after the last session of shock wave therapy (Figure 1), and in that exam the majority of the animals presented a score of zero at 60 days after the last shockwave therapy application (seven animals presented its score in the scale equal to zero in the inspection, six in the palpation, five in the mobility tests and 11 in the in movement exam).

In all parameters analyzed in the physical exam a significant statistic reduction in the scale values was found in Friedman's test ($P < 0.0001$) (0, 30, 60, 90 and 120). In the inspection exam there was a significant reduction in values between days 0 (zero) and 60, 0 and 90, 0 and 120 and between days 30 and 120. For the palpation parameter there was a significant reduction in values between day 0 (zero) and 60, 0 and 90, 0 and 120, 30 and 90 and 30 and 120. For the mobility tests there was a significant reduction between day 0 and 60, 0 and 90, 0 and 120, 30 and 90 and 30 and 120. Similarly, in the in movement test there was a significant reduction between days 0 (zero) and 60, 0 and 90, 0 and 120, 30 and 90 and 30 and 120.

It could be noticed the presence of supraspinous and interspinous desmitis, kissing spines and dorsal intervertebral osteoarthritis in the examined animals. All ultrasonographic classifications for ligament injuries, described by Alves et al.[2] and articular processes described by Fonseca[8] were found. It was observed a score reduction of the echogenicity, increasing of the parallelism scores and reduction of the articular processes scores at different times, obtaining a statistic difference in the average values for the echogenicity, fiber parallelism and appearance of the articular processes at 60 days ($P < 0.0001$).

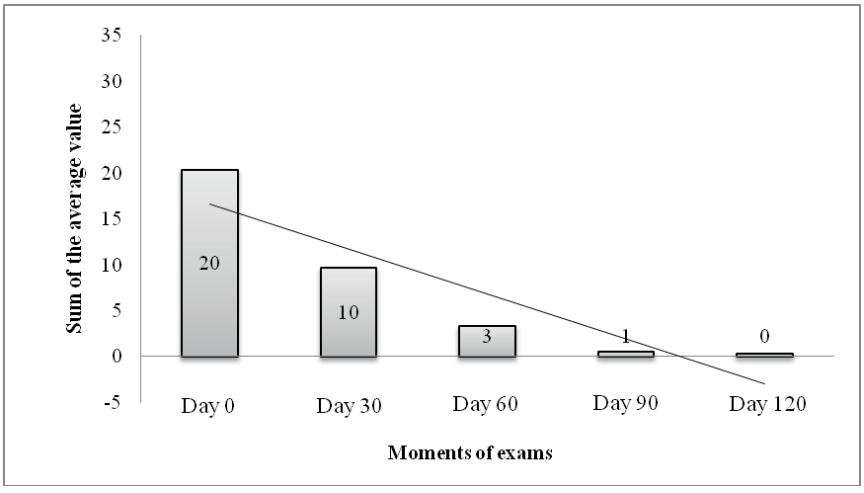

Figure 1 – Sum of the average value of all animals with standard deviation of the obtained values for injuries of the animal's physical exams in different examination days

Relating the evolution of the clinical exam with the ultrasonographic scores for the echogenicity and the supraspinous ligament parallelism it could be observed a positive association between them (P = 0.0003 *and* P = 0.005 respectively) (Figure 2); similarly, there was a positive association between the score reduction in the severity scale and the ultrasonographic appearance evolution of the articular processes (P = 0.027) (Figure 3).

Discussion and Conclusions

Still today there are difficulties in examining animals that do not have local or specific pain, which is the case of back pain. Currently, it can be found in the literature a subjective classification of the clinical signs of these animals, classifying the cases in mild, moderated and severe[4,5], which can be justified by the physical exam goal proposed by the authors, that is to confirm the presence and predict the origin of the back pain as thoracic, lumbar or pelvic. However, it is already noticed the necessity of the creation of a graduated system, suggesting a scale from 0 to 10, with the aim of monitoring the progression or regression of individual parameters at different times[7].

In the present study, the gradation of the physical exam findings was necessary for a better evaluation of the animals, especially to compare the different mo-

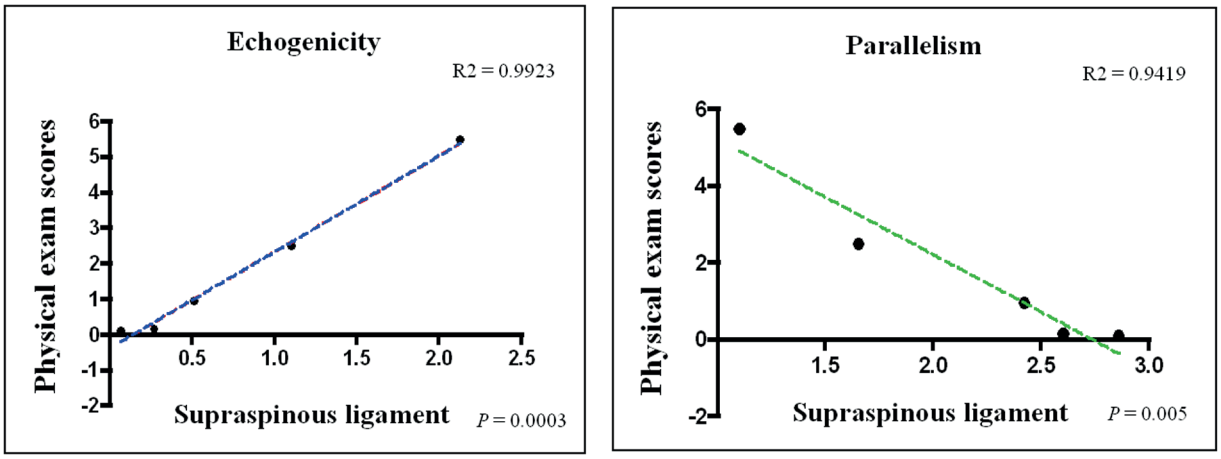

Figure 2 – Line regression graphics showing the relation between the clinical evolution of the animals and the ultrasonography scores for the echogenicity and fibers parallelism of the supraspinous ligament

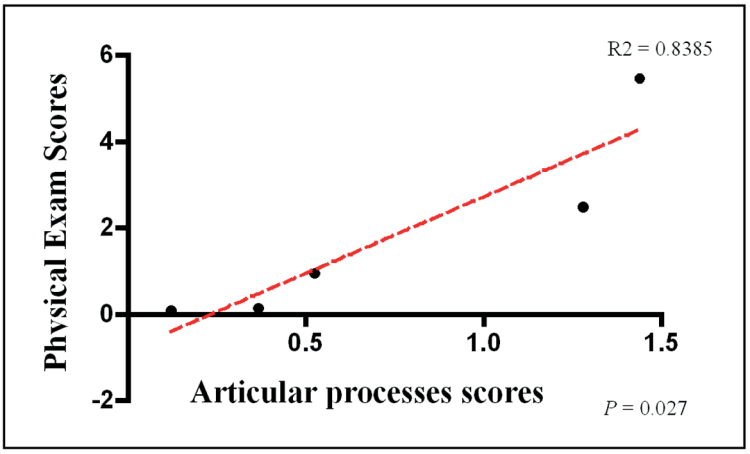

Figure 3 – Line regression graphic showing the positive relation between the clinical evolution of the animals and the ultrasonography scores for the articular processes appearance

ments, in other words, the first clinical exam and the time post-treatment.

The pain scale used was determined based on protocols and rules of evaluations in humans' spinal column, from which an adaptation was performed. Among the propaedeutic systems that were consulted, two, that evaluate a higher number of functional[19,20] parameters, stand out more than the others from other researchers where the classification is based only on the history and patient's[21,22] level of pain. Despite the postural and biomechanical difference between human and equine spines, the parameters used as the basis for the preparation of this protocol were only the level of pain and the response to passive mobility tests. Because the human spine mobility is greater than that of horse, and the parameters of pain clearer, adjustments were made following the findings of one study[8] about the clinical examination of animals with back pain.

Diagnostic anesthetic blocks were not used as part of the physical exam suggested by other authors[5,23] because the anesthetic injection could make it difficult to make the later evaluation of the structures by the ultrasonographic exam as shown in a previous spinal ultrasonography study[24], so, as the ultrasounography was the only image technique used in this study, the option was not to use the blocks.

The standardization of the gait alteration for each injury in an isolated way was not possible because the examined animals in the present study presented more than one type of injury in the moment of the exam, they had chronic and acute injuries that coexisted, according to the information from another study that finds animals affected by kissing spines and acute supraspinous[25] desmitis and also chronic desmitis associated to acute myositis[26].

Nevertheless, the scale was very useful in clinical monitoring of animals studied and submitted to shock waves for the analysis of the evolution of the clinical status, revealing significant reduction in pain, characterized by reduction of the changes represented in the scores of the animals in different moments.

A positive evolution of the clinical status was observed in the physical exam performed 60 days after the last session in all evaluated parameters. This result is close to the one found in a study with animals affected by osteoarthritis[27] that reported an improvement in the animals at 42 days post-treatment.

The improvement in the animals' clinical status, demonstrated by the value scales of the physical exam was accompanied by an improvement in the ultrasonographic images of the supraspinous ligament and articular processes in the treated areas, showing a positive and relatively fast response of the tissues to the therapy.

The ultrasonographic scores for echogenicity and fiber parallelism followed the results of the physical exam, fact that was proved by the positive association found in the regression test, being that at 60 days it was already observed a significant alteration in scores, resembling results from another study[28], that reached the normalization of these parameters in 70% of the animals at 90 days. It was also observed that the injuries classified as acute, in other words, hypo and anechoic images in the ligament, responded faster (between 60 and 90 days) than the chronic injuries, observed as hyperechoic images (between 90 and 120 days).

As for the articular processes, the ultrasonographic response to the treatment came later than the clinical's response because the image normalization occurred at 120 days, being that also at 60 days a significant alteration in the scores was observed, corroborating with other findings from another study[29] that until 90 days after the tarsic osteoarthritis treatment did not observe bone remodeling associates to the clinical improvement of the animals and also with a study performed in rabbits[30] that found a clinical improvement in the animals without, however, finding compatible radiographic alterations.

Thus, from the results we can conclude that the classification and gradation of the physical exam in scores within a range of intensity showed to be efficient in the thoracolumbar exam in horses and allowed the monitoring of the clinical course, as well as the response of the diseases to the proposed treatment based on the positive relationship between changes in scores of physical examination and sonographic parameters. Furthermore, the results showed that 60 days is the ideal time for the first revaluation of the animal after the treatment because is the minimal time to find changes in the physical and ultrasonographic exams on the thoracolumbar injuries.

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