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Long-term Follow-up of Manipulative Treatment in a Horse with Back Problems

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With 5 figures and 2 tables

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Summary

In order to objectively quantify the effect of manipulation on back-related locomotion anomalies in the horse, a recently developed kinematic measuring technique for the objective quantification of thoracolumbar motion in the horse was applied in a dressage horse that was suffering from a back problem. In this horse, clinically, a right-convex bending (scoliosis) from the 10th thoracic vertebra to the second lumbar vertebra was diagnosed. As a result, there was a marked asymmetric movement of the thoracolumbar spine. Functionally, there was severe loss of performance. Thoracolumbar motion was measured in terms of ventrodorsal flexion, lateral flexion, and axial rotation using an automated gait analysis system. Measurements were repeated before and 2 days after treatment, before the second treatment 3 weeks later, and at 4 weeks and 8 months after the second treatment to assess long-term effect. At the same time, performance of the horse was assessed subjectively by the trainer as well. Symmetry of movement improved dramatically after the first treatment. After this, there was a slight decrease in symmetry, but 8 months after the last treatment the symmetry indexes for the various joints were still considerably better than during the first (pre-treatment) measuring session. Subjectively, the trainer did not notice improvement until after measurement session 4. Between sessions 4 and 5 (at 4 weeks and 8 months after the second treatment) there was a change of trainer. The new trainer did not report any back problem, and succeeded in bringing the horse back to its former level in competition. It is concluded that manipulation had a measurable influence on the kinematics of the thoracolumbar spine. However, it is recognized that an improvement in symmetry of motion is not equivalent to clinical improvement and that other measures, such as changes in management, may be more decisive.

Introduction

Interest in equine back problems has increased considerably in recent years. However, they are, by no means, a new plague to the horse. In 1876 Lupton (cited by Jeffcott, 1999) remarked that back injuries 'are among the most common and least understood of equine affections'. Back problems are little understood mainly because of our limitations in the correct diagnosis of these ailments and in the correct interpretation of the abnormalities that are found. The lack of clarity in diagnosis and overall vagueness surrounding back problems, the high degree of subjectivity with which the manifestations of back problems are perceived, and the apparent lack of effectiveness of traditional medicine make these problems into an ideal target for the many forms of alternative medicine.

Orthomanipulation is a way of therapy that is frequently used in both horses and humans. The principle of orthomanual medicine is based on exerting effects on function of the vertebral column by manipulation direct on the vertebrae (Sickesz and Bongarts, 1989; Albers and Keizer, 1990). Diagnostic possibilities are lateral deviation from the midline, or axial rotation of the cervical, thoracic or lumbar spine. The pelvis can have an asymmetric position in the form of a tilt or a shift, which displacement is related to dysfunction of the lumbar spine. During manipulation short-lever, high-velocity, low-amplitude, controlled thrusts are applied directly on the tuber coxae, spinous processes and/or transverse processes to induce a therapeutic response in joint structures, muscle function or nerve reflexes. The ultimate goal of orthomanipulation is restoration of symmetry and mobility as much as anatomically possible. As an alternative for traditional therapies, manipulations of the back by this or related techniques such as chiropraxis are becoming more widely used in man and horses, but are still controversial in both. Research has been limited so far. Herrod-Taylor (1967) reported a complete cure in five of seven horses after chiropractic manipulations, and a considerable improvement in the other two. However, this report lacks any quantification and the number and variety of vertebrae that had to be 'replaced' during the various sessions these patients underwent is surprisingly high. In general, most reports are anecdotal, and the impression exists that the response to manipulation is often dramatic but short-lived (Jeffcott, 1979). In recent years, some scientifically sound work on the effect of chiropractic manipulation on the equine thoracolumbar spine was published (Haussler, 1999; Haussler et al., 1999). It was shown that substantial segmental spinal motions, which were beyond the normal range of segmental motion that occurs during locomotion, could be induced by

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chiropractic manipulation. In that investigation, standing horses that were equipped with strain gauges attached to Steinmann pins were used, which had been implanted in the spinous processes of various vertebrae. Although this work meant a breakthrough in the age-old discussion whether inter-vertebral (micro-) movements in the equine can be induced at all by manual manipulation, it did not prove effectiveness in the sense of any alteration in use of the back. Further, no information was provided about the longevity of the induced effect.

In the present case report, a newly developed and validated non-invasive technique for the quantification of kinematics of the equine back (Faber et al., 2000, 2001a) was used to evaluate the effectiveness of manual manipulation in terms of changes in spinal kinematics in a horse with a well-documented back problem. This technique has been proven to yield highly reproducible results (Faber et al., 2002). In order to assess long-term efficacy of the treatment, the horse was measured several times over an 8-month period. The kinematic data were compared with the subjective impressions of both the osteopathic physician and the trainer of the horse.

Case Details

History

A 7-year-old Dutch Warmblood dressage horse (535 kg, 166 cm height at the withers, mare) was presented to the clinic. The horse used to compete at a medium to high level, but at the time of presentation there had been complaints of poor performance for over 9 months and the horse had been out of training for the last 3 months. The main complaints were that the horse resisted the hand of the rider, reared often, did not bend well to the right and showed poor tracking of the hind feet.

Findings at the clinical and orthomanual examinations

At clinical examination the horse appeared not to be lame when trotted along a straight line on a hard surface. However, hypertrophy of the lumbosacral musculature was observed together with an increased responsiveness to deep palpation in this area. In the mid-lumbar area, scoliosis was noticed with a right convexity. When observed from above during movement, an asymmetry in the degree of lateral bending and axial rotation was evident. There was a good lateral bending to the left, whereas there was hardly any lateral bending to the right. The asymmetry in lateral bending became most clear at the trot. The asymmetry in axial rotation of the sacrum was most prominent at the walk. The left tuber coxae had a considerably larger vertical movement range compared with the right tuber coxae. A clinical diagnosis of lumbar scoliosis and strain of the extensor muscles of the back was made. During the ortho-manual assessment, performed under sedation, the osteopathic physician (MS) came to the same diagnosis: a right-convex bending that started in L2 and extended craniad up to T10.

No imaging techniques were used as it was deemed that radiographic or ultrasonographic examinations were not likely to yield further useful information. Facilities for scintigraphy were not available. Creatinine phosphokinase (CPK) and aminoaspartate transferase (AST) levels were measured in peripheral venous blood samples taken at rest and 1 h after exercise, but were within the normal range.

With the owner's consent, it was decided to treat this horse by orthomanipulation and, apart from the subjective judgement of the trainer, to assess the possible effects of this treatment using a newly developed technique to quantify reliably the thoraco-lumbar kinematics of the equine spine.

Pre-treatment kinematic measurements

First, the horse was accustomed to treadmill locomotion during 1 week. After that period, the first measurement session which served to document the initial situation was performed.

The validated kinematic analysis protocol has been described in detail elsewhere (Faber et al., 1999, 2001a). Summarizing, reflective spherical markers were placed over the dorsal spinous processes of eight vertebrae (thoracic 6, 10, 13 and 17; lumbar 1, 3 and 5; sacral 3) and the left and right tuber coxae. The position of these markers was measured using a commercially available ProReflex® motion analysis system (Qualisys AB, Sävedalen, Sweden) during treadmill walking (1.8 m/s) and trotting (4.0 m/s). From the position data of the markers spinal kinematics were calculated.

The basic locomotor pattern was described by the spatio-temporal parameters velocity, stride length and stride duration. The spinal kinematics were visualized by time-angle diagrams for the three rotations (flexion and extension or longitudinal bending in the sagittal plane, transverse bending in the horizontal plane that leads to lateral bending, and torsion along the longitudinal horizontal axis, leading to axial rotation), and time-excursion diagrams for lateral bending. Quantification of the spinal motions was carried out in terms of range of motion values and intravertebral pattern symmetry (Faber et al., 2000).

Manipulative treatment and follow-up kinematic measurements

It was decided to treat the horse with two treatment sessions with a 3-week interval. Directly following the first measurement, the horse was treated for the first time. During this session the horse was treated by an orthomanual realignment technique, i.e. a direct short-lever high-velocity thrust towards the neutral position of the areas where an impaired mobility had been noted during the clinical examination. The areas treated were pelvis, lumbar region (L1–L2 joint) and lower cervical area. In addition to the treatment, mobilization exercises (walking along serpentines) were prescribed that had to be performed slowly without a rider during the first week and from then on with a rider.

To obtain information about the short-term effects of orthomanipulative treatment, a second measurement was performed 48 h after this treatment. Three weeks after the

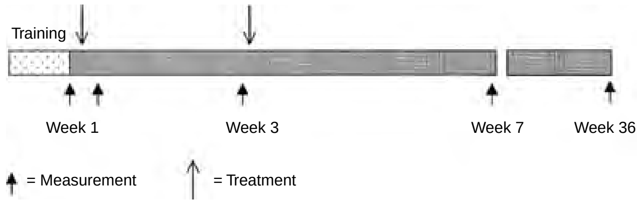

Fig. 1. Diagrammatic time-line of events (treatments, measurement sessions) of the case described.

first treatment, the horse was measured again and immediately thereafter the horse was treated in the same fashion as during the first session. At 4 weeks and 8 months after the second treatment, the fourth and fifth measurement sessions were carried out for long-term follow-up. The time-line of events is represented in Fig. 1.

Results

Subjective assessments

Trainer

According to the trainer, there was no improvement in performance, not after the first treatment, and not after the second treatment. However, before the last measurement session (8 months after the second treatment), the horse had been sent to a new trainer. This trainer still noticed a certain degree of asymmetry in the back, but a high level of dressage performance was reached again without alleged back problems.

Osteopathic physician

Three weeks after the first treatment, the osteopathic physician noticed a substantial reduction of the right-convexity. However, there was still a reduced mobility in the L1–L2 region to the right.

Kinematic analysis

The spatio-temporal parameters velocity and stride duration were comparable in all measurement sessions, but the stride length showed some variability. Especially at the third session the stride length was reduced, with a concomitant decrease in stride time, during the walk compared with the other sessions, with a comparable velocity. At the trot, the stride length was increased at the fifth session, but this was in combination with a slightly higher velocity (Table 1).

Forty-eight hours after the first treatment a large improvement could be observed in the degree of scoliosis, which became apparent in the position along the vertical axis of the lateral excursion movement patterns (Fig. 2). It was interesting to observe that, although the direction of movement was abnormal, the range of lateral excursion mobility was not reduced in the scoliotic situation, i.e. at measurement 1. This effect is illustrated in Fig. 3.

For the flexion–extension movement patterns in the sagittal plane all sessions showed a certain degree of intravertebral pattern asymmetry (Fig. 4). Asymmetry was maximal in the first session. Intravertebral symmetry values were <0.90 for all vertebrae during both the walk and the trot in the first session, whereas they were ≥0.90 in most of the other sessions. Another interesting feature, that was noticed in the flexion–extension movement patterns of the L5-vertebra, was the occurrence of flattened peaks. These were present in the first four sessions, but were lacking in the last session (Fig. 4). In the third session, the range of motion was reduced by approximately 1° at the walk in all vertebrae.

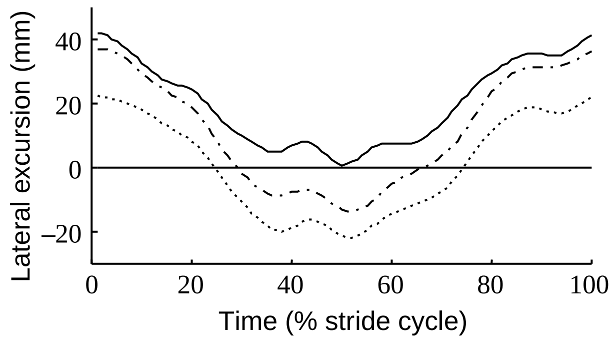

Fig. 2. Lateral excursion movement patterns at the trot (4.0 m/s) of L1, at measurement session 1 (solid line), session 2 (dotted line) and session 5 (dashed-dotted line). Ideally the pattern should be symmetrical around zero. Notice the large deviation from zero at the first session and the normalization in session 2. At the fifth session, a tendency towards one side is noticed again, but there is still considerable improvement compared with the initial situation.

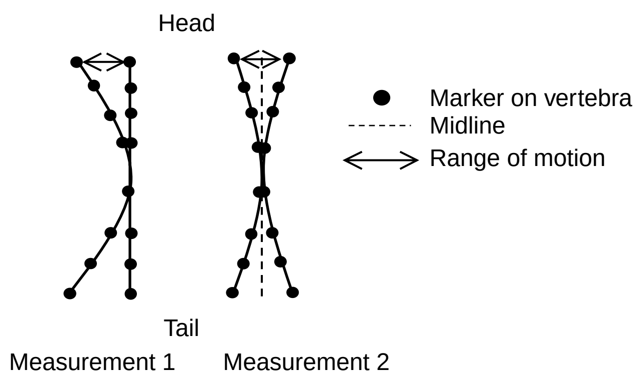

Fig. 3. Illustration of the lateral excursion pattern, at the moment of measurements 1 and 2. In both diagrams, the two extreme lateral excursion positions of the vertebrae during one stride cycle are plotted (top view). At the moment of measurement 1, the left diagram presents the extreme lateral excursion positions, whereas during measurement 2, the back moved more like the right diagram. Note that the range of motion is similar in both situations, although the movement is very asymmetric in the left diagram.

Table 1. Spatio-temporal stride characteristics (mean ± SD) of a horse suffering from back problems during a period of treatment by orthomanual manipulation. The treatments were given just after measurements 1 and 3

Parameter	Measurement 1	Measurement 2	Measurement 3	Measurement 4	Measurement 5
Walk, 1.6 m/s					
Velocity (m/s)	1.59 ± 0.01	1.61 ± 0.04	1.60 ± 0.02	1.61 ± 0.02	1.65 ± 0.02
Stride duration (s)	1.11 ± 0.02	1.10 ± 0.03	1.02 ± 0.02	1.09 ± 0.02	1.08 ± 0.02
Stride length (m)	1.76 ± 0.03	1.77 ± 0.04	1.62 ± 0.05	1.76 ± 0.02	1.78 ± 0.04
Trot, 4.0 m/s					
Velocity (m/s)	3.95 ± 0.03	3.92 ± 0.03	3.98 ± 0.01	3.99 ± 0.02	4.07 ± 0.01
Stride duration (s)	0.69 ± 0.01	0.71 ± 0.01	0.70 ± 0.01	0.71 ± 0.01	0.71 ± 0.01
Stride length (m)	2.73 ± 0.04	2.78 ± 0.04	2.78 ± 0.03	2.82 ± 0.03	2.88 ± 0.04

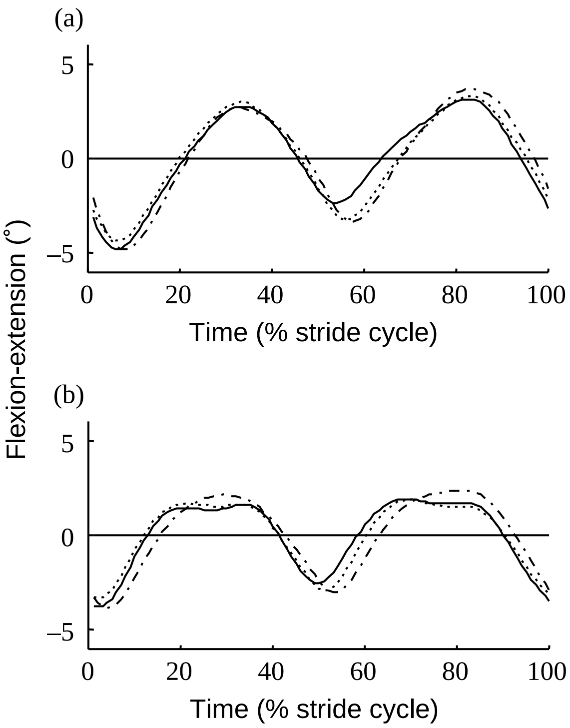

Fig. 4. Flexion–extension movement patterns at the walk (1.6 m/s) of T17 (a) and L5 (b), at measurement session 1 (solid line), session 2 (dotted line) and session 5 (dashed-dotted line).

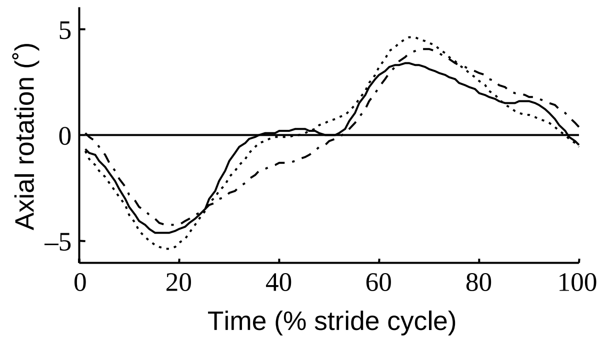

Fig. 5. Axial rotation movement patterns at the walk (1.6 m/s) of the sacrum, at measurement session 1 (solid line), session 2 (dotted line) and session 5 (dashed-dotted line).

For lateral bending (perpendicular to the sagittal plane), a remarkable increase in range of motion was observed in the thoracic vertebrae when comparing sessions 1–4 with session 5 during both the walk and the trot (Table 2). In the lumbar vertebrae there was no clear pattern of changes in the range of motion values during the various sessions.

For axial rotation of the sacrum the results of the first session showed a very irregular movement pattern. In the later sessions, the pattern became more fluent (Fig. 5). In the first session, the range of motion was only reduced at the trot.

Discussion

The data from this study indicate that the manipulative treatment considerably affected thoracolumbar kinematics during especially the second, fourth and fifth measurement sessions. These changes exceeded well the day-to-day variability as can be expected when horses are tested on successive days (Faber et al., 2002), and as such can be assigned to the treatment.

The kinematic results showed clearly aberrant patterns during the first and third sessions, while in the other sessions the results looked more like the patterns that have found to be characteristic for clinically sound horses at the walk and trot (Faber et al., 2000, 2001b). This indicates that the effects of the first manipulation on the spinal mobility were dramatic, but did not last long. The second treatment session induced a longer lasting effect. Comparing the walk and the trot, the movement patterns at the walk showed more improvements. This may not be surprising, as it is known that the vertebral column of the horse is made as rigid as possible during the trot by more extensive and greater muscular activity in order to prevent wasteful lateral movements (Robert et al., 1998). Therefore, it can be stated that the walk is a more sensitive gait for spinal kinematic analysis than the trot.

Various kinematic parameters changed during the follow-up period. These parameters might to a certain extent represent an adaptation to the severity of the back problem and therefore be useful as indicators for back problems. In the third session, a reduced stride length during the walk and a reduced flexion–extension range of motion was most notable. The reduced range of motion is most likely a consequence of the reduced stride length in this session. Apparently, the horse reduced the amount of flexion–extension back movement by shortening the strides in order to spare the sore back. Indeed, a

Table 2. Lateral bending range of motion values (in degrees) of a horse suffering from back problems during a period of treatment by orthomanual manipulation. The treatments were given just after measurements 1 and 3

Structure	Measurement 1	Measurement 2	Measurement 3	Measurement 4	Measurement 5
Walk, 1.6 m/s					
T10	10.7	9.9	10.1	10.5	11.4
T13	6.4	5.7	6.1	5.7	9.6
T17	3.2	3.5	4.2	1.9	5.8
L1	2.1	3.5	2.3	4.2	1.7
L3	2.7	4.1	2.4	5.1	3.0
L5	3.2	5.1	3.0	6.1	5.5
Trot, 4.0 m/s					
T10	7.7	8.5	10.3	10.0	12.0
T13	2.9	4.1	5.2	3.6	6.8
T17	2.2	3.0	3.9	2.9	5.1
L1	2.9	3.4	2.2	2.6	3.9
L3	4.4	5.1	4.7	5.4	2.5
L5	4.9	5.4	5.3	6.3	3.7

shortened stride length is a frequently observed complaint in horses with alleged back problems (Jeffcott, 1975). It is recognized that variations in treadmill speed will affect the kinematic parameters as well and may even, if large, influence spinal movement patterns. However, treadmill speed in the third session was identical to the first session, and overall variability did not exceed 4%. This variation is deemed to be too little to affect spinal motion.

The observed intravertebral asymmetry in the flexion–extension motion is most likely caused by the dissimilarity in the amount of protraction between the left and right hind limb. Unfortunately, this dissimilarity could not be quantified, as the amount of protraction could not be calculated based on the available data. However, from a study in clinically sound horses a close relation could be demonstrated between the amount of protraction and retraction of the hind limbs and thoracolumbar flexion–extension range of motion (Faber et al., 2002).

The flattened peaks in the flexion-extension movement pattern of the L5-vertebra, that had been noticed in the first four sessions, had disappeared in the fifth session. In clinically sound horses these flattened peaks are rarely observed. Faber et al. (2002) observed in a group of 10 clinically sound horses a flattened peak in only one horse in the lumbar vertebrae. Also in session 5, a substantially increased range of motion for lateral bending in the thoracic region was observed, whereas the range of motion values in the lumbar vertebrae did not change. The main change in the axial rotation movement pattern of the sacrum was seen between sessions 4 and 5 too. The fluency of this movement might therefore also represent some measure for spinal pathology.

It is interesting to note that in this sequential study there are two points in time when kinematic changes were most pronounced: between measurement sessions 1 and 2, and between 4 and 5, respectively. Of these changes, the change between sessions 1 and 2 seems most dramatic at first sight. However, when closely scrutinizing Figs 4 and 5 and the ranges of motion as given in Table 2, it is the question whether this is the case on the level of individual vertebral mobility. In fact, the individual motion patterns approach the normal situation more closely during session 5 than during any other session.

With respect to the functional appreciation of the horse's performance there is a change only during the interval between measurements 4 and 5. This appreciation is only in part subjective, as the horse indeed was able to compete at its former level, which was definitely not possible when the horse was first presented. It is recognized that during the interval between measurements 4 and 5 the trainer of the horse was changed. Of course, it cannot be ascertained what had happened, had the horse not been treated and only transferred to the new trainer. However, it is a fact supported by hard data that many kinematic characteristics changed after the first treatment and were still substantially different from the reference values 8 months after the first treatment. Therefore, in the opinion of the authors, this case supports that manipulative interventions may have a significant effect on spinal kinematics in the equine. Having said this, it is immediately recognized that this fact alone may not warrant clinical success. In the given case it is probable that, once the mobility of the back was improved through the manipulation, the methods of the new trainer were better for the rehabilitation of back function than those used by the old one.

It is concluded that manipulation, in this case orthomanipulation, had a measurable influence on the kinematics of the equine thoracolumbar spine. It is recognized that such an effect is not equivalent to a cure of any back-related problems and may even not necessarily be beneficial in all cases. However, the effectiveness of the method certainly gives it a place in the treatment of a number of ailments of the equine back. It can be anticipated that these treatments will be most effective when accompanied by supporting measures that may imply changes in the use or for instance the tack of the horse.

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