International
College for
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Equine
Osteopathy

Influence of Osteopathic Treatment of Horses Objectified

Effects of osteopathic treatment on mobility in the lumbar spinal column

Summary of the thesis
submitted by Annelies De Wispelaere and Hymne Rydant
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Introduction

Two students at the "International College for Research on Equine Osteopathy" (I.C.R.E.O.), Hymne Rydant and Annelies De Wispelaere, chose as their thesis subject the mobility of the lumbar spinal column, examined before and after osteopathic treatment. A significant improvement of both the symmetry and the amplitude of movement was observed in all the horses. This study shows clearly the positive effects of the treatment on the mobility of the lumbar spinal column.
We would like to thank the Faculties of Sport and Kinesiology and Veterinary Medicine of the University of Ghent

1. Purpose of the study

The purpose of this study is to examine analytical research of the movement of the lower back and pelvis during walking both before and after osteopathic treatment. Measurements are performed around the pelvis. The pelvis plays a key role in forward movement. The forces generated by the hindquarters during movement are transmitted via the pelvis to the spinal column and the rest of the body (Ridgway (2006), Haussler (2000), Denoix (2005), Audigé (2000)). On the assumption that the movements occur symmetrically in the pelvis, the transmission of the forces to the rest of the body will occur more smoothly. The reference points were the tuber sacrale and the tuber coxae. These are the most prominent points and also the easiest to palpate. The measurements were performed during walking, because this is the movement that mobilises the back most, due to the alternation of tripodal and bipodal states, which generate sinusoidal movements (Denoix, Audigié, (2001)). During the stride, in the sagittal plane there is a succession of flexion-extension movements, albeit to a limited extent. In the horizontal plane, there is a succession of lateroflexions which continue throughout the spinal column. In the frontal plane, we note relatively clear rotations. The symmetry in these rotations is a very important parameter, and teaches us a great deal about the mobility of the lumbar spinal column.
A first hypothesis predicts a difference in freedom of movement of the pelvis and lower back during walking after treatment. Freer and greater movement is expected.
A second hypothesis predicts a difference in the spatio-temporal paramaters of the pelvis in the frontal area. After treatment, it is anticipated that the tuber coxae move horizontally and parallel to the ground; this means that the tuber coxae are located at an equal height on both sides and rotate in equal measure on both sides.
A third hypothesis predicts a difference in the spatio-temporal parameters of the pelvis in the horizontal plane. Here, it is anticipated that the tuber coxae will move in a similar manner on both sides in the lateroflexions of the spinal column.

2.1 Study animals

Seven horses with known history and pedigree were chosen as study animals. The average age, build and weight of the study animals were (x ± SD) 9.6 ± 1 year; 1.63 ± 0.02m; 506.3 ± 47.3kg. Table 1 shows the individual values. The study animals were selected on the basis of a number of conditions: regular physical activity, racehorses and problems in thoraco-lumbar transmission and/or the hindquarters. The horse owners were given verbal and written details of the test procedures. The horse owners were also asked to comply strictly with the directives of the researchers during the tests.

Before participating in the study, the participants signed an 'informed consent'. The persons involved in the studys were allowed to discontinue their participation in the study at any time.

H	NAME	BREED	GENDER	AGE (y)	WITHERS (m)	BW (kg)	COLOUR
1	Coucoumie	Thoroughbred	Mare	8	1.60	400	Brown
2	Adja	Thoroughbred Criollo	Mare	17	1.56	500	Chestnut
3	Notable Du Houssoit	SBS	Gelding	8	1.74	600	Gray
4	Parona	KWPN	Mare	8	1.65	550	Chestnut
5	Chinook	-	Mare	11	1.59	500	Brown/grey
6	Selma	KWPN	Mare	7	1.62	500	Brown
7	Paride	Oldenburg	Mare	8	1.68	550	Black

Table 1: Physical characteristics of the study animals (y = age in years, m = withers height in metres, kg = body weight in kg)

2.2 Preparation

The tests were set up on a treadmill. This treadmill was set up in the veterinary clinic of the University of Ghent (Merelbeke), and a number of stables were connected to it.
The animals had never walked on a treadmill before; for this reason, it was decided to allow the study animals to walk on the treadmill for a quarter of an hour before the tests to allow them to become accustomed to it. This also allowed the horses to adopt their normal stride pattern.
After the study animals had been familiarised with the treadmill, identifying marks were applied to the animals. These were applied at the level of the tuber coxae and the tuber sacrale with an orange dye.

2.3 Recordings

The procedure consisted of two test days and three test sessions.
There was a time interval of 5 weeks between the two test days.

On test day 1, the study animals were analysed twice on the treadmill while walking. A first image analysis was performed during walking. After that, the horses were treated. After a half-hour wait, the animals again underwent an image analysis on the treadmill while walking (test session 2).
A 5-week interval was allowed between test day 1 and test day 2. On test day 2, another image analysis was performed of the study animals during walking (test session 3).
As far as possible, it was endeavoured to provide identical conditions for the first and second session day, so that the horses were subject to the least possible stress.

2.4 Setup

“Fixed points” were marked on the sides of the treadmill. These markings always had to appear in the picture during calibration and the recordings. These markings could be different for each camera.
The markers serve as a reference if the camera itself had to move. The markings used were a piece of black tape with white tape above it.
In order to obtain optimal images, extra lighting was placed along both sides of the treadmill.
The rear-view camera was set up in line with the axis of the treadmill. This camera was connected via a coaxial cable to the video recorder which recorded the images.
The camera for the top view was set up above the treadmill. This was secured on a vertical construction in the air, so that the camera was perpendicular to the treadmill and the lumbar spinal

column. These camera was connected via a coaxial cable to a second video recorder, to record the images.
Both recorders were connected to a monitor. In this way, the images could be checked during recording.

2.5 Processing of the results and statistical analysis

The video images were analysed using the Dartfish and SIMI Motion programs, successively from the qualitative and quantitative viewpoint. Next, for each study animal individually, it was examined whether there was a significant difference before and after treatment. Each of the test sessions was examined and processed. Finally, the study animals were assessed subjectively.

2.5.1 Qualitative analysis

The qualitative analysis was carried out via the Dartfish program. This was used to process, measure and compare the images in 2D.
The images on the video tapes were first digitized. Then the pictures were imported via the Dartfish program for further analysis.

2.5.2 Quantitative analysis

The quantitative analysis was performed via the SIMI Motion program. This enables image processing, and movements can be analysed comprehensively in 3D.

The images on the video tapes were first digitized. Then the images were imported via the Dartfish program for further analysis. From within Dartfish, the pictures were compressed so that they could be imported into the SIMI Motion program.
Via the SIMI Motion program, 3D-images could be processed. First of all, a specification had to be defined. Next, the cameras were set up and calibrated. The calibration cube was analysed in SIMI Motion. After that, the coordinates of the images, recorded via the cameras (rear view and top view), were converted into 3D.
The coordinates were ultimately calculated in 3D via the SIMI Motion program by placing manual points on each frame of the pictures on both tuber coxae and on the middle of the spinal column at tuber sacrale height. After all this had been done, the connections could be made in order to interpret the data.
Via the connections made by the SIMI Motion programme, the angles were calculated in Excel via trigonometry for both the angles (α) in the XY-plane (rear view camera) and for the angles (β) in the YZ-plane (top view camera).

2.5.3 Subjective analysis

The subjective analysis was obtained by interviewing the owners/riders of the study animals. They were asked about overall changes in the condition of the horse: welfare, manner, discipline, technical difficulties in riding. Then they were asked for a general assessment before and after treatment. The owners/riders had to give a score from 1 to 10, before and after treatment.

3. Results

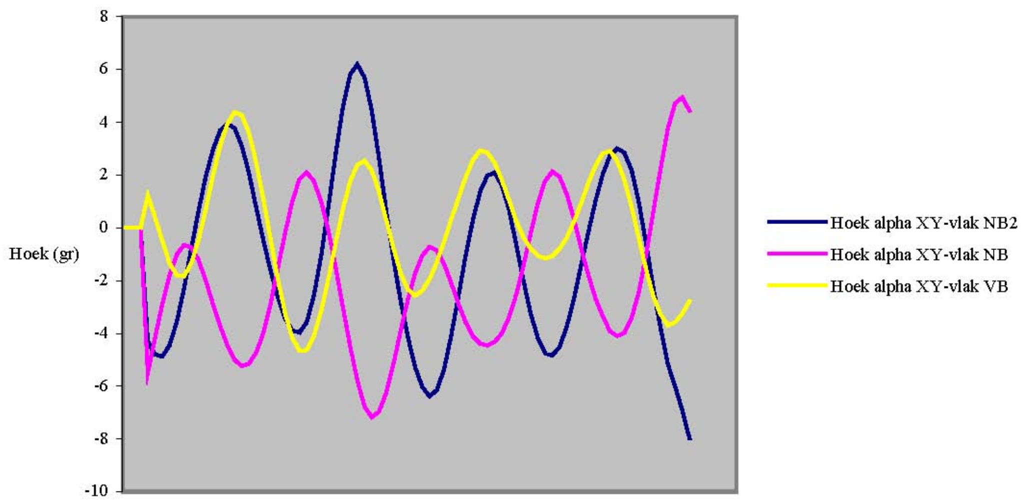
3.1 Quantitative analysis

For the quantitative analysis, the coordinates both tuber coxae of the study animals were used. By using these coordinates and trigonometry, the angle alpha in the XY-plane and the angle beta in the YZ-plane calculated between both tuber coxae, over time.
Next the angles "before treatment" (BT), "30' after treatment" (AT) and "5 weeks after treatment" (AT2) are compared in a graphic. In the graphics, the pattern of the angles in degrees (°) is shown over time. From this, it can be concluded whether there is a more regular pattern in the tuber coxae, which translates into a more symmetrical and regular stride pattern and/or there is a greater amplitude, which translates into a freer movement of the pelvis and the thoraco-lumbar spinal column.
The difference between the widest and narrowest angle is also shown in a table. These differences are compared for each of BT, AT and AT2. The greater the difference between the minimum and maximum angle, the freer the movement in the thoraco-lumbar spinal column and the pelvis.
Both from the graph and the table, a conclusion can be drawn in relation to the result on the movement of the thoraco-lumbar spinal column and the pelvis.

3.1.7 Study animal 7: Paride

The research results for one of the study animals are given as an example. This horse was chosen entirely at random.

3.1.7.1 Angles in the XY-plane



Graph 1*: P7 angle alpha XY-plane*

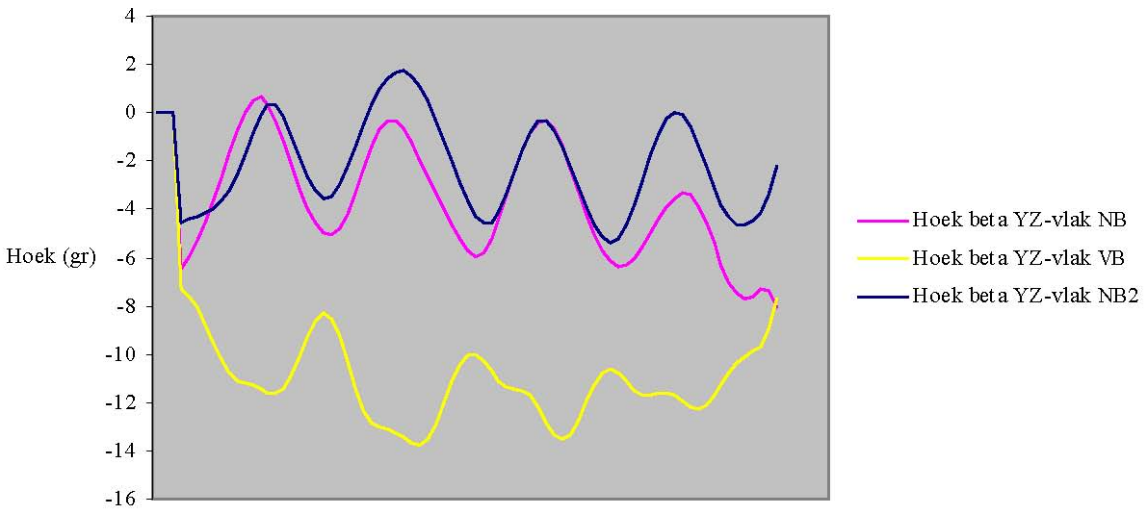
Legend:
Angle (gr)
Blue: Angle Alpha XY-plane NB2; Pink: Angle Alpha XY-plane NB; Yellow: Angle Alpha XY-Plane VB

	Before treatment	After treatment	5 weeks after treatment
min	-4.384293°	-4.949741°	-6.185387°
max	4.656662°	7.173052°	7.978532°
Difference between min and max	9.040955°	12.122793°	14.163919°

Table 2: angles in degrees (°) XY-plane P7

This graph shows the pattern of the values of the angle BT, AT and AT2 for the study animal Paride. These are the angles in the frontal plane or the angles between the tuber coxae from the rear view.
The table contains the minimum and maximum angle and the difference between these minimum and maximum angles.
Prior to the treatment, a small amplitude of the angles can be seen in the graph (yellow line). Five weeks after the treatment, however, there is clearly a greater and more regular amplitude (blue line).
In the table, the difference between the minimum and maximum angle is greater after the treatment (12.1°) than before the treatment (9.0°). Five weeks after the treatment, an even greater difference can be observed (14.1°).

3.1.7.2 Angles in the YZ-plane



Graph 2: ***P7 angle beta YZ-plane***

Legend:
Angle (gr)
Blue: Angle Alpha XY-plane NB2; Pink: Angle Alpha XY-plane NB; Yellow: Angle Alpha XY-Plane VB

	Before treatment	After treatment	5 weeks after treatment
min	-88.821098°	-81.555984°	-89.553261°
max	-84.179115°	-74.668686°	-78.723511°
difference between min and max	4.641983°	6.887298°	10.82975°

Table 3: angles in degrees (°) YZ-plane P7

This graph shows the pattern in the values of the angle beta BT, AT and AT2 for the study animal Paride. These are the angles in the horizontal plan or the angles between the tuber coxae from the top view.
The table contains the minimum and maximum angle and the difference between this minimum and maximum angle.
Prior to the treatment, a very irregular amplitude of the angles can be seen in the graph (yellow line). After the treatment, there is clearly a smoother line in the angles (pink line). Five weeks after the treatment, the amplitude is greater and more regular (blue line).
In the table, the difference between the minimum and maximum angle is greater after the treatment (6.9°) than before the treatment (4.6°). Five weeks after the treatment, an even greater difference can be observed (10.8°).

3.1.7.3 Conclusion
From the table and the graph – in the XY-plane (from rear view) – it can be concluded that the freedom of movement is greater in the lumbar spinal column after the treatment and greater still five weeks after the treatment. The rotation of the pelvis is greater and more symmetrical five weeks after the treatment.

3.2 Qualitative analysis

The Dartfish program was used for the qualitative analysis. In the processing of the images, it became apparent that it was not feasible to superimpose the “before treatment” and “after treatment” images and view them in a way that would show the difference in freedom of movement. Although the speed on the treadmill was always identical to the previous test session for each study animal, it was very difficult to superimpose the images. The first reason was the sideways movement of the study animals during walking. The second reason was determining the precise timeframe and the commencement of the movement, in order to superimpose the images.

However, the program was used to view the images of the study animals “before treatment”, “30’ after treatment” and ‘5 weeks after treatment’ side by side, and thus make an analysis. There was always a top view and a rear view in order to compare the study animals.

For study animal 7: Paride

Before treatment, the right tuber coxae did not come down during walking. Study animal 7 carries its right side stiffly when walking.

After the treatment, there as very little difference compared with before the treatment. However, there was more movement in the left side of the pelvis. Study animal 7 always walks with its pelvis upward.

Five weeks after the treatment, study animal 7 walked much less with its pelvis upward. There was a symmetric movement of the left and right tuber coxae. The movements in the lumbar spinal column were also freer during walking. The movements are much easier and more controlled than before treatment, but could still improve. Study animal 7 still slinks along the treadmill, and looks like it is shuffling along.

3.3 Subjective analysis

3.3.7 Study animal 7: Paride

Paride was given an entire week’s rest after the treatment. After that week, in the 2nd week, the horse was worked mainly on a long rein. Furthermore, she was ridden 3 to 4 times per week with loose reins or walked. After the treatment, Paride was much more lively in the ring. She also responds better to firm handling.

In the osteopathic examination of Paride, we still found a slightly sensitive area around the lumbar spinal column. However, there are no other problems any more.

Score according to the rider before the treatment: 6/10.
Score according to the rider after the treatment: 8/10.

4. Treatment

All the study horses were treated osteopathically during the first test session by the lecturers of the I.C.R.E.O. It was decided to treat each horse in its entirety, not just lesions that might be connected to the mobility of the lumbar spinal column and the pelvis. This is because an osteopathic treatment cannot be interpreted correctly if it is not carried out in according with best practice.
During the treatment, only manual techniques were used. The study animals received no form of sedation whatever before or during the treatment.
The following techniques were used:

- manipulative techniques: rebound techniques, strain-counterstrain, direct-thrust manipulations for the various parts of the spinal column;
- facial techniques;
- visceral techniques;
- cranio-sacral techniques

Discussion

The purpose of this research was to examine whether there was a difference in the analysed movement of the lower back and the pelvis during walking, before and after osteopathic treatment. This examination occurred via image analysis, whereby measurements were performed on two different days. This kind of approach must take account of the fact that the comparison of the results of the different days can be influenced by the reliability of the measuring instrument used (technical variability), as well as the day-to-day variability of the physiological variables (biological variability).
A few other things must be taken into account with regard to the study and the tests themselves.
In vivo treatment of the spinal column is more difficult due to a number of factors:
- the movements are complex and relatively small, making accurate measuring techniques necessary;
- the skin that covers the spinal column prevents direct observation and quantification of the vertebral movements;
- the paravertebral musculature it difficult to deal with the spinal column.

Working with transcutaneous markers could give us a more exact picture, but in view of the limited possibilities and the ethical question that arises in that context, this was ruled out as an option.
Remarkably little research has been carried out into the osteopathic treatment of horses. As far as the interest of this study is concerned, a longitudinal study is required, with a timespan of a few months.
The processing of the images in this study only involves five walking cycles per study animal. There are quite a lot of possibilities for expanding this study. The degree of transfer could be incorporated, as well as expanding the image analysis by recordings of the sagittal plane. One could also examine differences depending on the type of step: collected walk, medium walk and extended walk.
In the study, the study animals were not compared with "normal/healthy/control" horses. There is little or no literature about the normal stride pattern of horses. What is normal? What is right? What is standard? These are questions that cannot be resolved and which make comparison with a "normal/healthy/control" horse impossible. For that reasons, we only compare the horses before and after the osteopathic treatment and not with a control group and/or a standard pattern. One horse may display more rotation of the pelvis to compensate its walking movement, while another horse will display more lateroreflexion. Whether this depends on the breed, the discipline, etc. is unclear.
According to Faber et al. (2002), horses have an individual anatomical variability and an individual preference for a specific movement pattern. To maintain the same speed, they use a different combination of stride length and duration. Likewise, horses use different combinations of movements of the vertebrae to obtain the freedom of movement of the back that is necessary for the most supple movement pattern possible.
From this research, it emerged that the major differences were noticeable between measurement 1 and measurement 3. Thirty minutes after osteopathic treatment, there was an improvement in every case. This was less pronounced in comparison with measurement 3 in relation to measurement 1. These findings can be explained by the fact that the body needs a certain time after treatment to find a new balance. This is one of the basic principles within osteopathy: endeavouring to achieve homeostasis (A.T. Still, 1904).
It is hard to compare this study with other studies, since there have not yet been any studies into the effect of such osteopathic treatments.

During this study, a subjective analysis was also performed. Before and after the osteopathic treatment, the owner/rider of the study animal was asked to give a score out of 10 to its riding behaviour/stable behaviour. Five weeks after the treatment, the score was noticeably higher in each case. From this, we can conclude that for the owner/rider, an improvement was perceptible in the riding/stable behaviour.

Overall conclusion

In recent years, there has been considerable controversy about equine osteopathy. Various in vivo studies have been carried out into the movements of the back in various gaits by, inter alia, Denoix (1999), Faber (2000, 2001), Licka (2001), Wennerstrand (2004), Dyson (2004) and Keegan (2004). Van Weeren et al. (2002) did a long-term follow-up of manipulative treatments of horses with back problems. Wakeling et al. (2006) looked into the effect of spinal manipulation and reflex inhibition techniques. Haussler treated horses using chiropraxis. Too little is known about the efficacy of osteopathic treatment of horses because too few independent studies have been published in this specialist field. Therefore it is necessary to carry out more research into these treatments of horses. This study showed that the movements of the pelvis and lower back were more symmetrical and smoother. The quantitative and qualitative analysis showed an improvement half an hour after the treatment. Five weeks after the treatment, an even greater improvement was noticeable. The subjective analysis, consisting of the scores awarded by the owners/riders of the horses, and requested five weeks after the treatment, also showed an improvement. From the quantitative, qualitative and subjective analysis, it can be concluded that osteopathic treatment gives an improvement in the movement of the horse’s pelvis and lower back.

Percentage changes for the 7 study horses.

	Before treatment	After treatment	Difference	%	After 5 weeks	Difference	%
1	7.194193	7.922189	*0.73*	**10.12**	12.752483	*5.56*	**77.26**
2	8.319684	19.932261	*11.61*	**139.58**	20.16588	*11.85*	**142.39**
3	10.678693	17.633328	*6.95*	**65.13**	18.41739	*7.74*	**72.47**
4	7.214138	10.88483	*3.67*	**50.88**	11.329165	*4.12*	**57.04**
5	8.696087	10.45836	*1.76*	**20.27**	14.817974	*6.12*	**70.40**
6	10.589044	13.311665	*2.72*	**25.71**	14.476439	*3.89*	**36.71**
7	9.040955	12.122793	*3.08*	**34.09**	14.163919	*5.12*	**56.66**
1	5.5564	5.714699	*0.16*	**2.85**	14.139557	*8.58*	**154.47**
2	9.352249	15.144012	*5.79*	**61.93**	15.843056	*6.49*	**69.40**
3	6.130539	9.263519	*3.13*	**51.10**	9.338013	*3.21*	**52.32**
4	7.34079	9.290871	*1.95*	**26.57**	10.695129	*3.35*	**45.69**
5	8.040038	8.742897	*0.70*	**8.74**	13.411217	*5.37*	**66.81**
6	7.859856	8.284889	*0.43*	**5.41**	10.171898	*2.31*	**29.42**
7	4.641983	6.887298	*2.25*	**48.37**	10.82975	*6.19*	**133.30**

Table 4: Percentage changes for the 7 study animals

SA 1	4	7
SA 2	6	8.5
SA 3	6	8
SA 4	8	9
SA 5	6	8
SA 6	6.5	8
SA 7	6	8

Table 5: subjective changes in the study animals. Score out of 10.