

Suppleness of the horse

- Effects of the Mounthy massage blanket –

1



Thesis

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¹ Image source: (monika-und-roland-pausch.com)

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1. Summary

Increasing the suppleness of the horse is comparable to the warming up of an athlete. It allows optimal motion, so damage to joints and musculature do not occur.

The application of the Mounty Massage blanket promises loose and uninhibited movement. This is already on the rise. Thus, it should have an effect on the suppleness of the horse. In this research, the changes in suppleness has been documented.

We have used back vibration as a measurement for the suppleness of the horse. A direct link between the back vibration and suppleness is not known, however, this assumption has been made due to various anatomical and physical conditions. The assumption is supported by observations and experiences of horse and rider. A change in suppleness would also create a measurable change in back vibration.

The goal of this research is therefore to measure the difference in back vibration which the massage blanket is responsible for.

To measure this, six horses were filmed on a treadmill. They wore a fly sheet with fixed points, so a computer could evaluate the level of back vibration. This is possible by using Dartfish Software to track certain pixels in the video. Using this tracking function, specific pixels can be tracked from frame to frame and their displacement can be recorded. A comparison measurement without the massage blanket was initially made.

The vibrations of the horses' back, which is a key feature of suppleness, was measured. The points on the horses back went with the movement. These movements were precisely recorded in the vibration charts. The relative change was particularly important. The suppleness should show by means of a higher amplitude of vibrations. In other words: the greater the vibrations, the greater the movement of the fixed points. To prove the positive effects of the massage blanket, an increase in amplitude must be detected.

It should show that the massage blanket has an influence on the vibration of the horse's back. The results show, that the back vibrations of all the horses increased after use of the massage blanket. Thus, it is proven that the massage blanket had a positive effect on the suppleness of the horse.

2. Introduction

With horses, suppleness is a central concept. It's similar to an athlete warming up. The muscles are stretched and relaxed in order to subsequently allow optimal movement. Suppleness is, so to speak, the basis for the optimal performance of the horse. Without it, horses can suffer from cramps, lameness, or chronic pain. Everyone wants a healthy, powerful horse, so it is essential to be aware of how supple your horse is.

The Mounty Massage blanket (Abb. 1), according to the brochure, promises "uninhibited and stronger backs"² so the horse can subsequently be ridden with a better posture.

Can a massage blanket have a measurable effect on the suppleness of the horse? In this thesis we will answer this question by measuring the vibration of the horses back, which should produce a change in suppleness.

Until now, we had no unit to measure the suppleness of the horse. There was no previous supply of work to reference. There has been no work or study using similar methods or investigating similar themes. This makes this research all the more interesting.

Various anatomical and physiological conditions of the horses back can be assumed to be connected to the motion of the back of the horse.

The hypothesis reads: the average level of amplitude after use of the massage blanket will be higher than without.



Abb. 1: Mounty Massage blanket in use.

²(<http://www.bm-agrotech.ch>)

3. Basics

3.1.1 Anatomy and Physiology

In this study we will use the back vibrations to measure the suppleness of the horse. We must use the method described (in chapter 4.2) with the defined points along the horses' back, so the data could be gathered and measured. To find the optimal position for the points we must take a closer look at the anatomy of the horse, particularly of the back.

The back is one of the most complex aspects of the musculoskeletal structure of the horse. It is key for the support of the spine, it connects the muscles and ligaments and transfers power from the front to back end of the horse. The spinal column consists of fifty to fifty-seven vertebrae. The ribs are located at the thoracic spine, and form the chest. (shown in blue in Abb. 2)

The back band begins at the withers and runs towards the tail. Attached is the rear thoracic spine and the lumbar spine (shown in blue and orange in Abb. 2). It ends with the sacrum (shown in dark green in Abb.2) which lies over the long back muscle. This is the most important muscle. It is fleshy and serves motion, this means it is neither a carrying muscle or a retention muscle. This muscle and the spine move in pairs. When moving forward they contract alternatively.

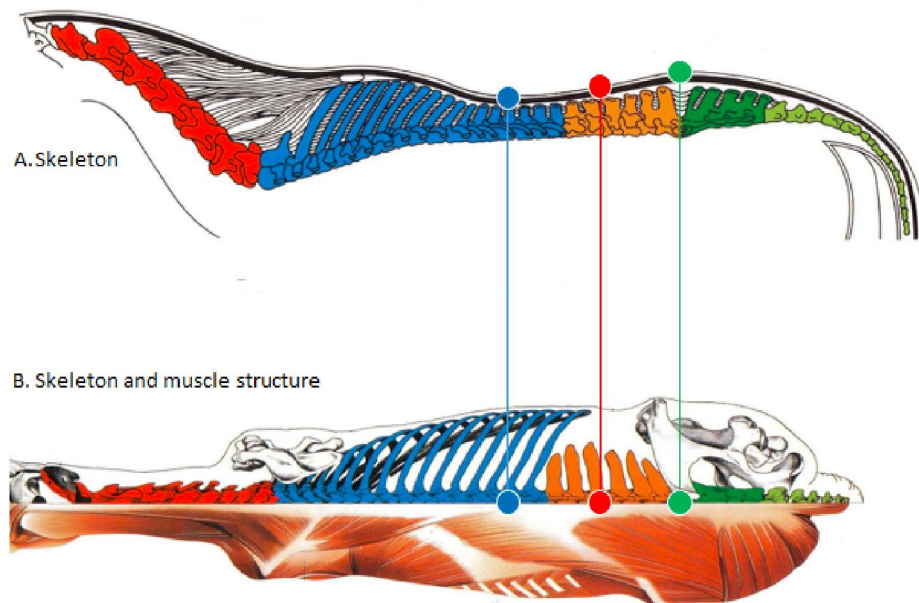


Abb. 2: Back anatomy of the horse
(www.sattelberater.blogspot.ch)

The anatomy of the horse is not designed to carry great weight. The natural centre of gravity is mostly on the forelegs, approximately at the level of the breastbone. The motion of the horse is complex,

particularly with a rider. Many of the horses' muscles are not designed for carrying weight, but are for movement.

If the horse moves and spread its lower neck muscles, the back is pushed down, and the abdominal muscles are stretched. In this case, the spine is squashed together, and the vertebrae rub against each other. This can cause inflammation to occur.

If a horse moved with a rider the same as it would in nature, it would cause serious injury. The back of the horse can be compared to a bridge. When a load is not directly above the shoulder or pelvis, the back will sag. A suppler horse can bare this better, which allows it to gather.

Assembly (abb. 3) occurs when there is an increased weight on the horses' hindquarters. By changing the centre of gravity (Abb. 3) the horses' forelegs have more leeway, this can, for example, allow it to rise faster in show jumping.³

A looser horse can be ridden better in the assembly.

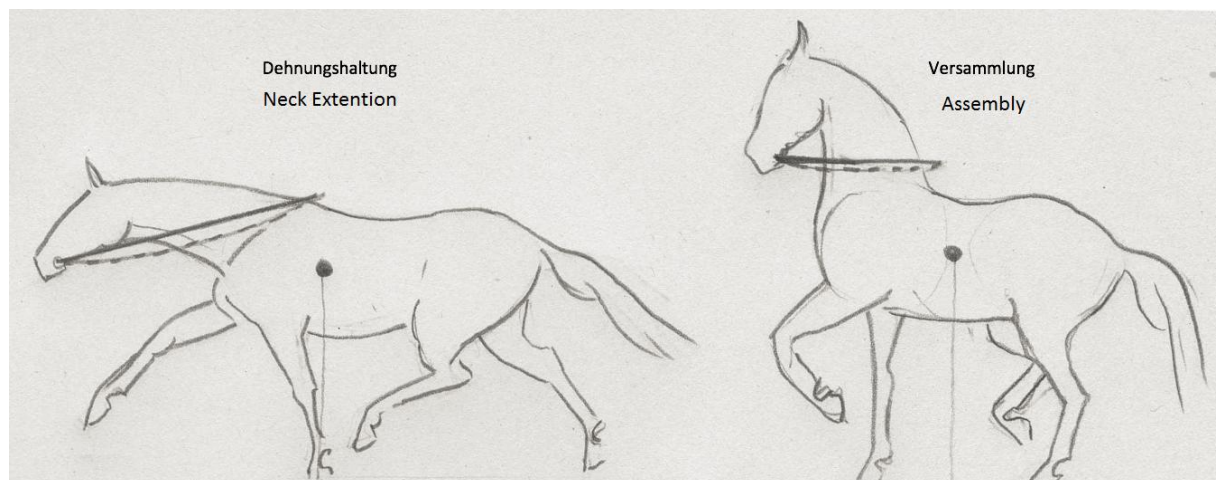


Abb. 3: shifting the centre of gravity (left, neck extension, right assembly)
(www.coreloop.com)

With this knowledge, we can decide where to place the points of reference on the back. The points have been selected so the moving parts of the back are examined. Since the part of the back just above the shoulder and pelvis are rather static, they have little influence over back vibration or suppleness. However, the part in between is highly flexible, therefore, the back vibrations were measured here.

Since the front part of the back is usually only lifted/lowered when the head is lifted/lowered (Abb.2), special attention was paid to the rear part of the back. Three points were spread out in this area so the vibrations here could be measured.

3.2 Suppleness

³Heuschmann

3.2.1 Definition

“Suppleness” is understood to mean the free and uninhibited movement of the horse, allowing the muscles to work economically. A stiff horse consumes more energy, and is therefore quickly exhausted, thus a stiff horse is less efficient. Good blood flow to the muscles is vital for the optimum performance of the horse. Without it, the muscles deplete quickly.

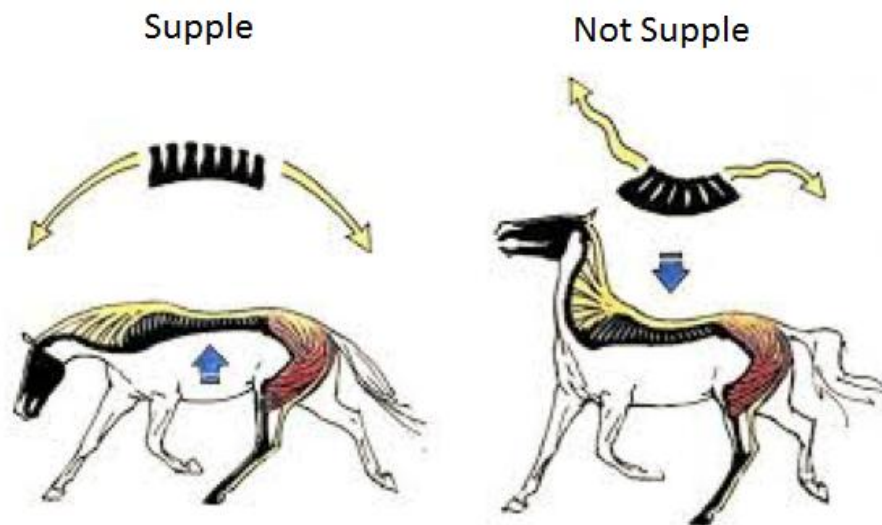


Abb. 4: Simple representation of different poses (left: supple, right: not supple)
(www.topspine.ch)

In Abb.4, a supple horse is compared with a stiff one. More specifically, the different ways a horse will act when supple or stiff. The positioning of the back is often decisive in the suppleness or stiffness of the horse. If the muscles contract to sharply, it will make the horse tense, and result in bad posture. The vertebrae rub together as shown in Abb.4 and can cause bruising and inflammation.

A rider would cause the horse more discomfort in this situation. In the relaxed, extended neck position, as shown on the left of Abb.4, the vertebrae are pulled forward, ensuring the best possible movement of the horse.

3.2.2 Characteristics of Suppleness

An important characteristic of suppleness is an even back swing. This shows the muscles working are loose. By combining the use of the back and hindquarter muscles, the tail of a relaxed horse swings easily with the movement.

Furthermore, the horse will lower its head and go into a relaxed position so the back is stretched and the tail is carried. The head and neck should move to the beat of its steps, therefore, there should be a clear nodding of the head. When the horse is relaxed, it has a closed, chewing mouth, and a calm expression.

This means no aggressive positioning of the ears or wide, anxious eyes. Relaxed horses often lick with their tongue. Biting around the bit or gnashing of teeth are clear signs of a tense horse.

To make things easier for the rider, it is important to be able to recognise these signs, as they are big indicators of how the horse feels. There are some signs the rider must pay attention to also.

Abb. 5 shows a direct comparison of the horse in two different positions. On the left, we see the horse being ridden with a correct position, with a vertical head, the centre of gravity above the hindquarters, and its legs parallel. On the right, it is clear to see the head is not vertical and its legs are not parallel. The centre of gravity is also in the incorrect position. This horse is not well gathered and cannot be ridden in the correct position. This horse is not supple.



Abb. 5: Comparison posture of the horse
(www.pferdewoche.ch)

The head of the horse in Abb. 6 is clearly behind the vertical line. "The top line [b] resembles a hilly landscape, and the muscles are clearly defined. The hindquarters are edgy and the flanks are gaunt. The longer back and abdominal muscles are not sufficiently developed."⁴

Line [b] shows how tense the horse is. At the mouth, we can see how the horse is fighting against the action of the bridle and rider's hand. The strong hand is also reflected in the overly bent neck [a]. The flanks are poorly filled in [d], and the hindquarters are poorly muscled [c]. This horse is clearly tense and was trained incorrectly.

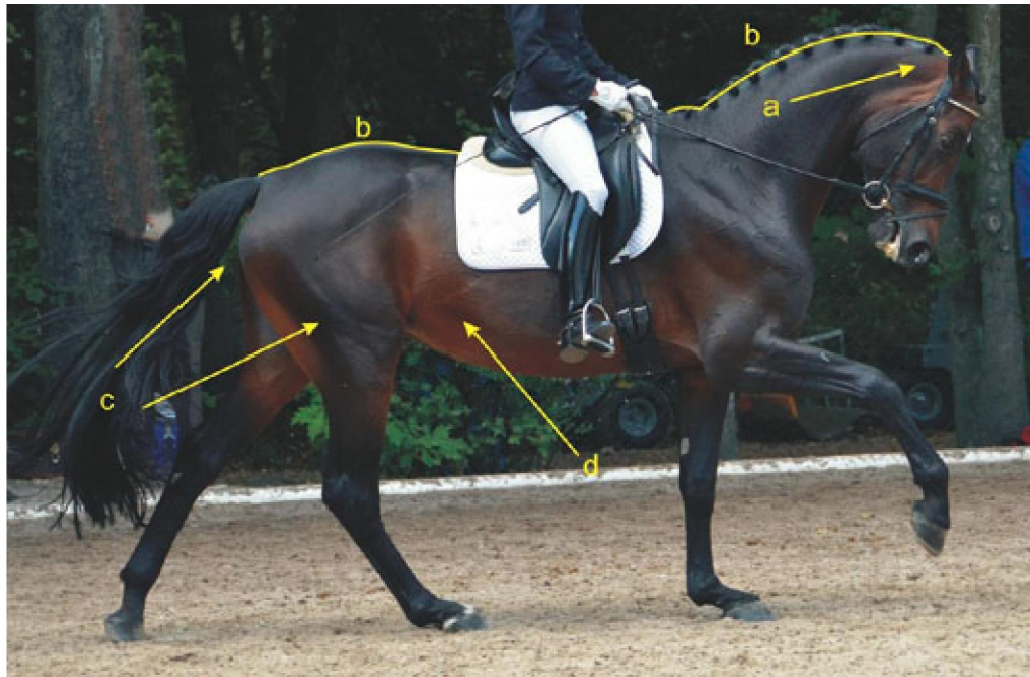


Abb. 6: Muscle build of an incorrectly ridden horse.
(www.hippothek.de)

⁴(www.hippothek.de)

Loosening up is one of the most important aspects of training for the horse. Nevertheless, even Grand Prix horses like Totilas, ridden by Edward Gal in the image (Abb.7), can be ridden in such a strained state.

Here we see another example of an obviously stiff horse. The back is tense, the head too close to the chest, and most obviously: the legs are not parallel. With the back this tense, it is impossible for the horse to move its hindquarters correctly. We can also see that the bit is at an almost 90-degree angle to the mouth, the rider clearly has a strong hand.



Abb. 7: Verspanntes Pferd (Edward Gal mit Totilas)
(www.hestenettet.dk)



Abb. 8: Loose horse with optimum head position (Caroline Häcki on Rigoletto Royale)
(dressurleistungszentrum.de)

On this horse (Abb. 8) we can see a much better head position. The horse carries its head on the vertical line and the neck is the highest point of the horse. The legs are not perfectly parallel, however the horse carries its tail loosely and its back doesn't look tense. Unlike Abb. 6, the back is less hilly. The croup is significantly less visible in comparison to Abb. 7. We can also see that the bit is not as angled.

It is important to consider suppleness as a whole. Just because the legs aren't perfectly parallel, it doesn't mean the horse isn't relaxed and supple. The head, back and tail are all being carried correctly.

For example, in Abb. 9, the legs are perfectly parallel, but the head, back and tail are incorrect. The back is forced down, we can see this because of the indentation just behind the saddle (blue circle). The head is in front of the vertical line and carried very high, as a result, the back is compressed. Evidence of this can also be seen with the tense tail. We can see a hilly back, which shows the horse is tense (purple line).



Abb. 9: Correct head, leg and tail posture
(www.pferderevue.at)

Neck Extension

The neck extension (Abb. 10) plays a key role in suppleness. The muscles are stretched and released, so the horse can move loosely and energetically. The horse can be strained at the beginning and end of a ride, so having the horse loosen up before work is a good way to ensure the muscles are relaxed after work.

When ridden with the correct amount of neck extension, the horse is capable of carrying the extra weight of the rider without straining its back muscles. This position pulls the back and vertebrae forward, and the back muscles are put under less stress. Considering the layout of the anatomical connections around the spine and long back muscles, we must pay particular attention to these muscles when determining suppleness.⁵



Abb. 10: Correct neck extension
(www.pferderevue.at)

⁵Dressage riding instructor Markus Graf

4. Material and Method

4.1 Test Horses

The horses used in this study were all housed in the same stables. This has not affected their suppleness. All the horses were tested on the treadmill with a field of view that was familiar to them, this prevented any strange stimuli from effecting the results. Furthermore, all horses had previously been trained on the treadmill.

The following horses were used in the trial:

- ABC Piri
- Calando X
- Callista
- Cassina AH
- Chicoletto
- For Pleasure's Little Boy

These horses had a variety of sexes, heights, colours, breeds and ages. (Appendix I Test Horses).

4.2 Method

To measure the suppleness of the horse, the back vibrations were analysed. This was done by videotaping the horses which was subsequently analysed with the computer.

4.2.1 Equipment

Horse Gym Treadmill

The Horse Gym Treadmill 2000 was used. It has 9 set programmes, with a manually adjustable slope and speed. The maximum slope is 8° and the maximum speed is 10km/h. Each horse moves at a different pace, and was thus adjusted to enable optimum movement of the horse.

Dartfish Software

As mentioned earlier, to measure the suppleness of the horse, the back vibration was measured. However, this movement is difficult to measure. So, it was done with a special software developed by the Dartfish company. The software is used by athletes, trainers and coaches to analyse videos of training and to optimize exercise. The software works by tracking certain pixels through the video. Specific points were marked by these pixels from frame to frame, and their movement measured.

Mounity Massage Blanket

“No more ‘gripping up’ when riding – instead, a relaxed yet hard working back during work”⁶ Promises the Mounity Massage blanket. It gently massages the back, followed by knocking and vibrations with a relaxation period in between. The massage begins at the withers before following along the long back muscle. This promotes blood flow and muscle toning. This effect should be demonstrated by changes in

⁶(www.bm-agrotech.ch)

back vibration. During the massage, three different levels can be selected. To achieve the greatest impact, the “strong” setting was used. A massage lasts approximately 20 minutes.

4.2.2 Set Up

In order for the Dartfish software to measure the vibration of the horses back, it needed points on the horse to track. For the tracking to work, dots made of wool were fixed to a fly blanket. For the measurements without the massage blanket, yellow dots were used. For measurements with the uses of the massage blanket, green dots were used. When applying the Massage blanket or the fly sheet, the horses were tied in place

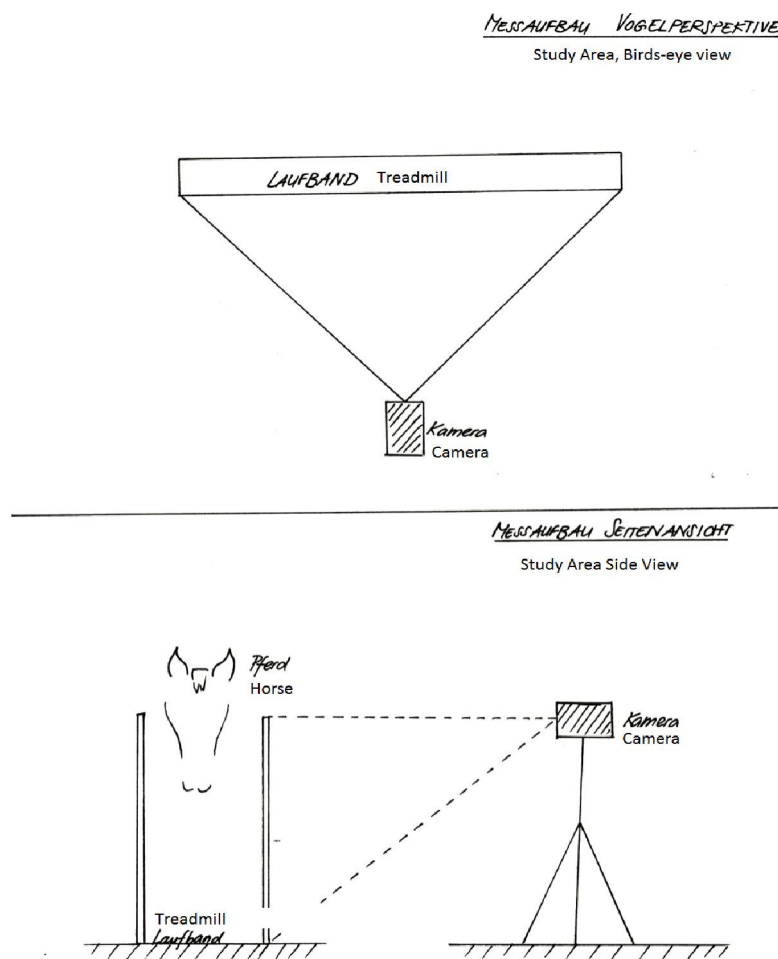


Abb.11 Work area Sketch

Abb. 11 shows how the experiment was set up. The camera was set up 1.5m from the treadmill so the whole horse was displayed on the screen. When the horse was on the treadmill the recording began.

In Abb.12 the experiment set up is shown. The camera was put in the correct position before the horse got on the treadmill. On the wall behind the set up was a black cloth to ensure the best possible contrast to the points on the fly blanket.

When on the treadmill, the horse had a limited freedom of movement and limited field of view. There was approx. 15 – 20 cm of distance between the horse and walls of the treadmill. The horse is tied on both sides of its head.



Abb.12 Work space

Any possible shift of the camera angle and size of the horses were subsequently compensated (see Appendix Abb. 32 and 33). Three of the horses were tested directly after treatment with the massage blanket, this way, time of measurement could be ruled out as a cause of change.

First, a fly sheet was placed over the horses with pieces of Velcro attached just above the spine. On the counterpart pieces of Velcro, balls of yellow or green wool were attached, they could then be attached to the fly sheet. The yellow wool was used for the measurements without the massage blanket, and green used for measurements after treatment with the blanket. Measurements on the treadmill took exactly 30 minutes and were done without slope.

4.3 Suppleness on the treadmill

On the treadmill, the horse has no influence of a rider. This means, the horses are not collected. Consequently, they move in their natural way. On the treadmill, one can see the suppleness of the horse, especially when examining the position of the head and neck. Tense horses press strongly against

the restraints with the head and neck and the strain of the muscles is distinct. Correct neck extension, however, is an indication of suppleness, and the horse can relax its neck and back muscles. One could compare the back of the horse to a rope. A tense rope is not as strong as a slack one. This would also apply to the back of the horse, and will in turn effect the back vibration.



Abb 13. Strained horse on the treadmill (Calando without massage blanket)

In Abb.13 we can see how the horse is pressing against the restraints and no expansion is visible. The neck is significantly higher than the withers. This has pressed the spine down. The horse is not supple. We can see that the tail is supported, but doesn't swing loosely.



Abb. 14 Supple horse on the treadmill (ABC Piri, with massage blanket)

With the next horse we can see its head is well below the withers. The horse is at the correct level of relaxation and is clearly supple.

5. Results

Using the Dartfish Company software, the movement of three points along the horses back was tracked along the Y-axis with a tracking function. The data was then converted using MATLAB software and calculations performed.

With the aid of a specialist and the MATLAB software a Fourier Transformation was made. This allowed us to determine the mean back vibration. More detailed information on the calculations can be found in 'Appendix IV Calculations'

The horse sizes (Appendix Abb. 32) and camera angle (Appendix Abb. 33) were recorded. As shown in the sketches, the values were normalized.

For example, Abb. 15 and Abb. 16 show the back vibrations in the range of 5 to 6 minute. In this research we wanted to find to height of the back vibration and consequently the average amplitude level. In this example (Abb. 15) the 0.74cm value was used, and not the average of 23.54cm, because we wanted to define the approximate deflection of the horse's back. In Abb.16, 0.93cm was the desired value.

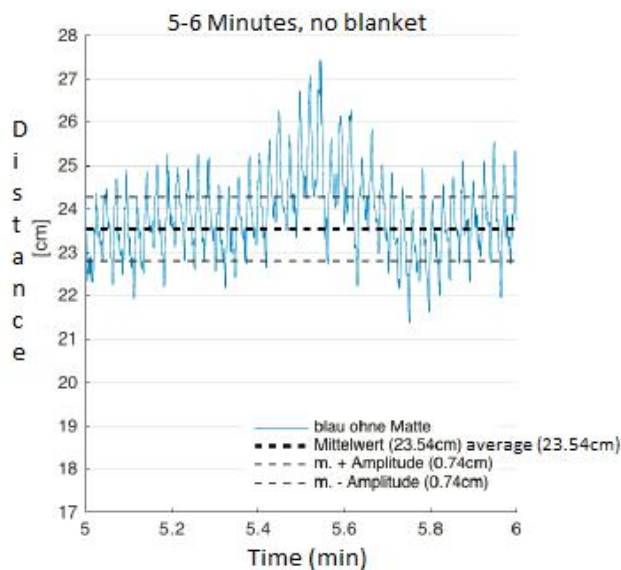


Abb. 15: Diagram of Callista, blue, no blanket (zoom)

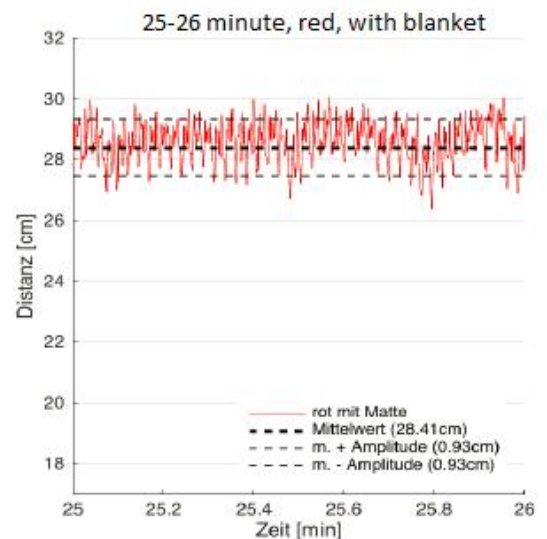


Abb. 16: Diagram of Chicoletto, red, with blanket (zoom)

In Abb. 17, it can clearly be seen that the vibrations are greater with the use of the massage blanket than without. This is shown with the broken lines.

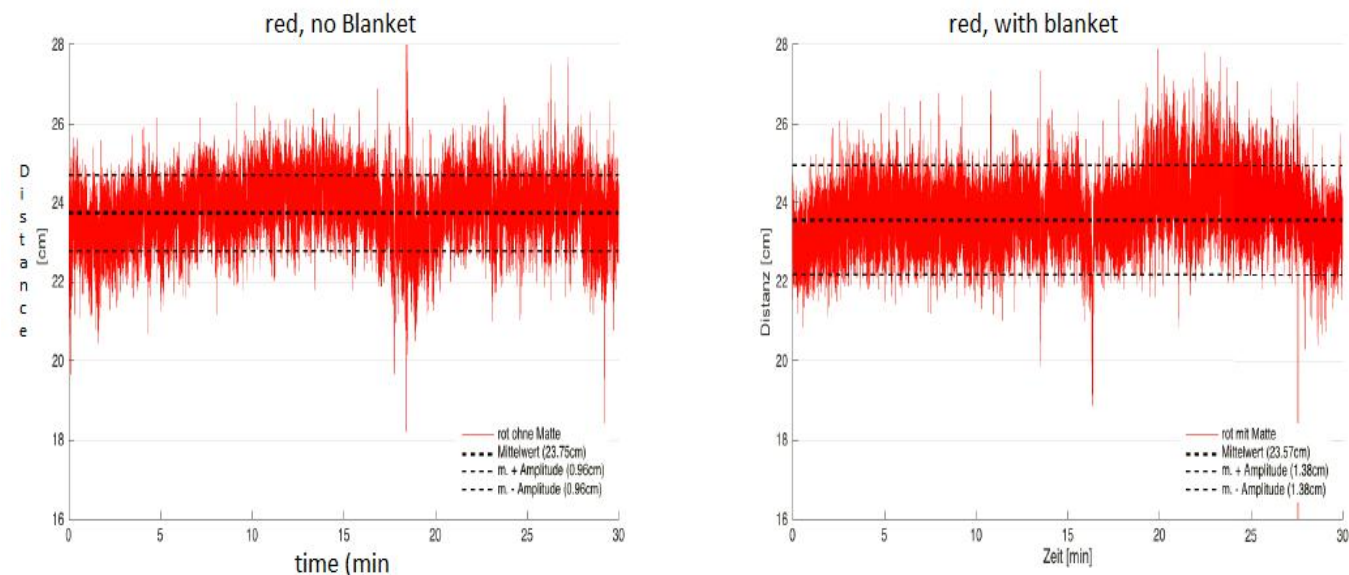


Abb. 17: Diagram, ABC Piri. red

Throughout the experiment, the vibrations remain at approximately the same level, and the eye can see no substantial difference. However, this doesn't mean there was no influence on the average vibration level, and had an impact on the results of the work. This can be seen in Abb. 18.

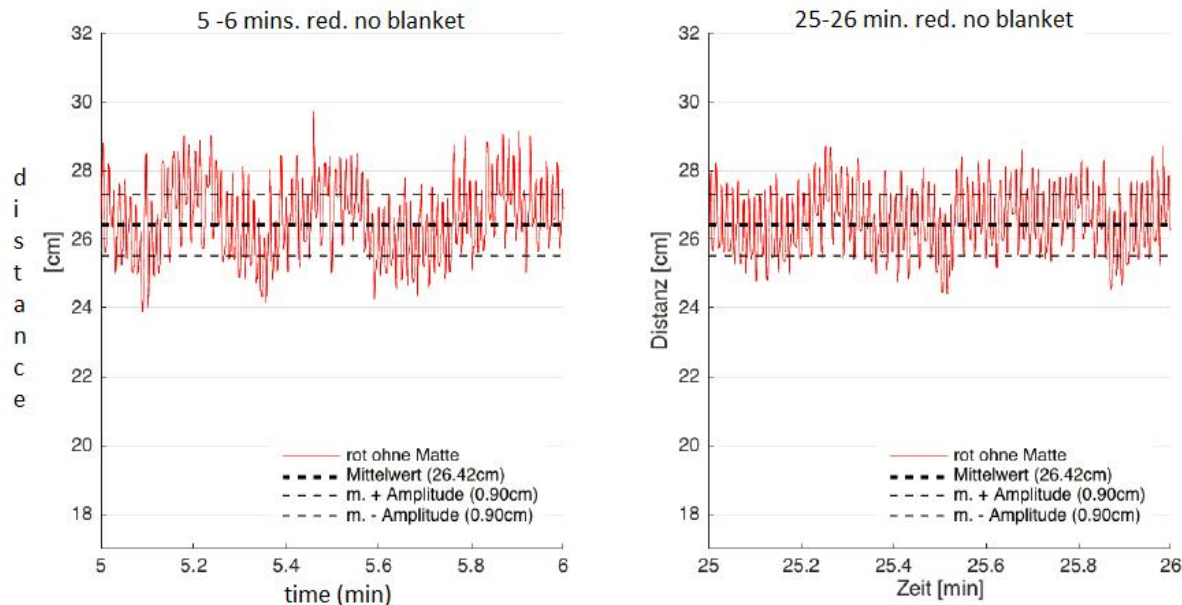


Abb. 18: Diagram, Little Boy, red, without mat (zoom)

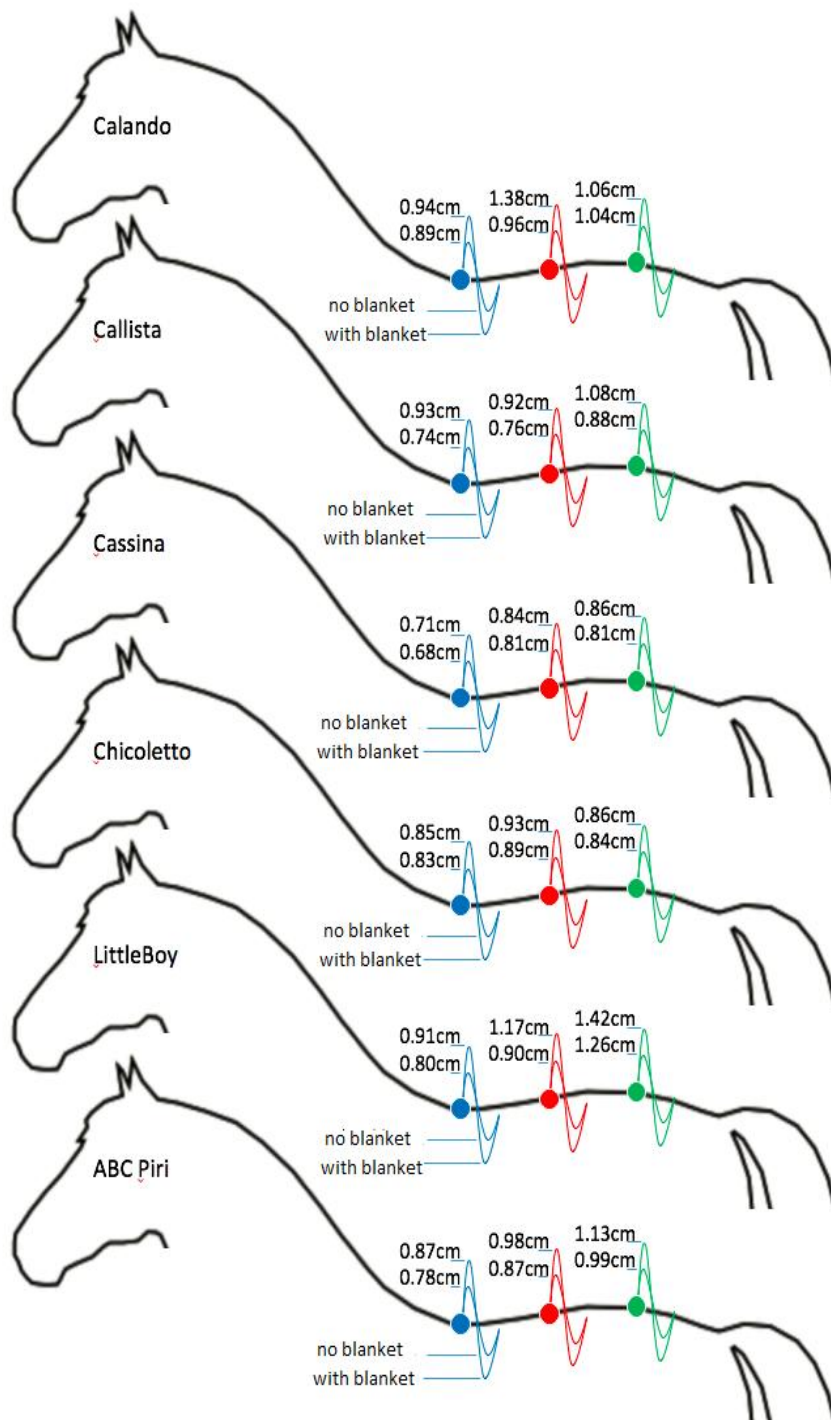


Abb. 19: measurement results (horseback sketches)

In Abb. 19 the results are shown. The curves show the average amount of movement, with individual measurements for with and without the use of the blanket.

The results after use of the massage blanket are higher than without its use. The amount they changed varied depending on the horse.

For most of the horses, the vibrations of the green dot were the greatest, and the blue dot had the smallest.

Furthermore, the point the massage blanket had the strongest effect on varies. For three horses, the greatest change occurred in the middle point, for two horses, the third point was most effected, and only one horse had the greatest change in the first point. Even with the horse that showed the least amount of change between wearing the blanket and not wearing it, the change was significant.

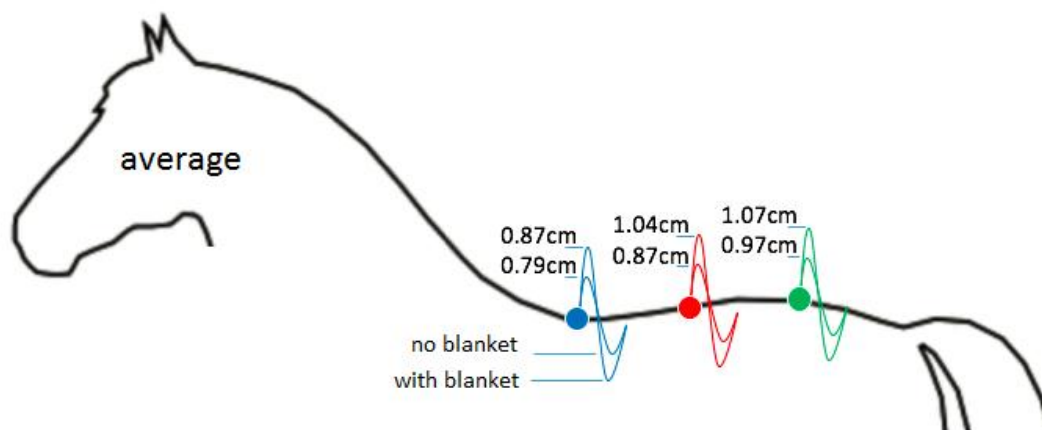
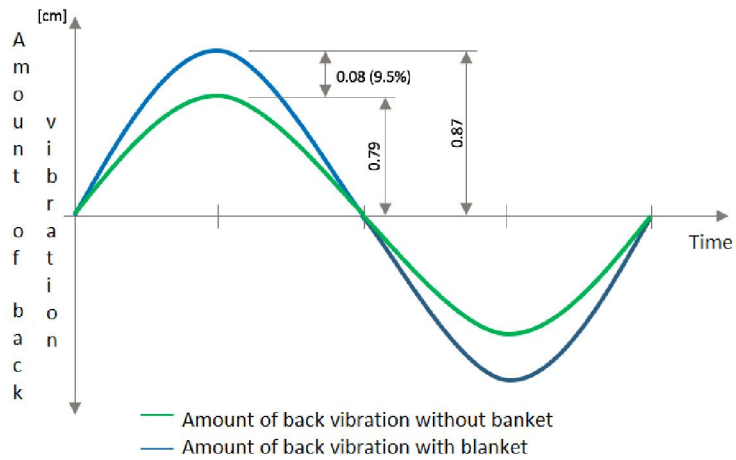


Abb. 20: Averages of all measurements. (horseback sketch)

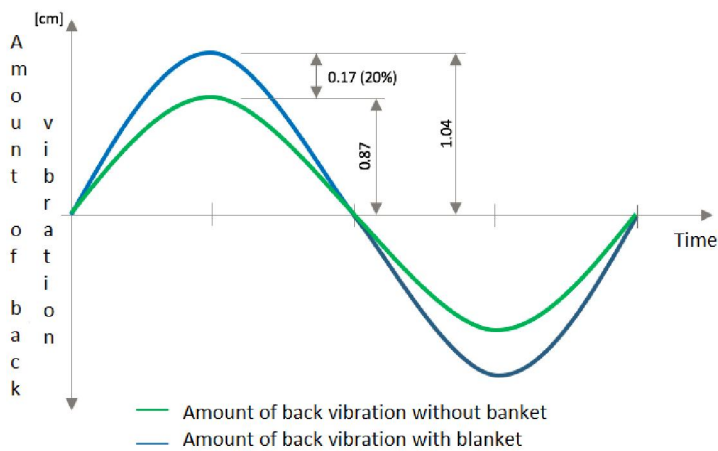
In Abb. 20, the average values of all the measurements are shown. Here, the curves show the average values of all the measurements.

Again, the values are all higher with the massage blanket. We can see that the green dot shows the greatest amount of vibration.



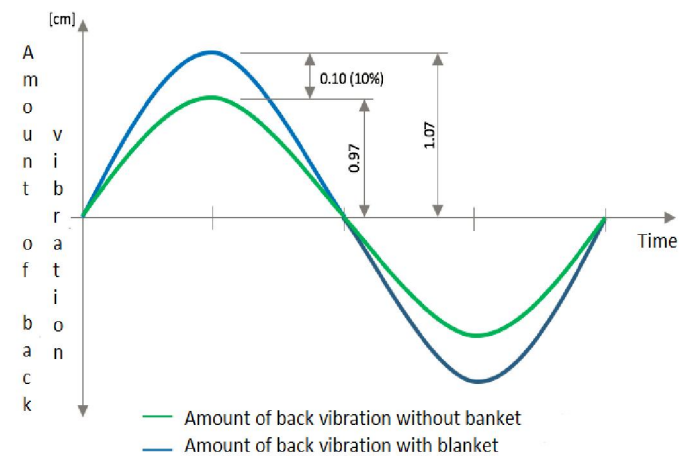
The back vibration of the blue dot (Abb.21) Average of 0.79cm without massage blanket and 0.88cm with massage blanket. Thus, the back vibration increased by 0.08cm, or 9.5%

Abb.21: Variation in back vibration, Blue dot



The red dot shows an increase in back vibration to an average of 0.17cm, (abb.22) from 0.87cm to 1.04cm. An increase of 20%

Abb.22: Variation in back vibration, red dot



A 0.10cm (10%) increase occurred with the green dot. From 0.97cm to 1.07com.

Abb.23: Variation in back vibration, green dot

6. Discussion

The back vibrations of the horse are significantly higher with the massage blanket than without. The massage blanket greatly improved the movement of the horses back. The effect on the long back muscle effects the mobility of the spine as the back vibration increases. This looser back has an effect on the entire horse's anatomy as it is all connected to the spine. Loose muscles are a clear feature of suppleness.

The hypothesis of the study was confirmed. The massage blanket fulfils the promise of a more uninhibited back.

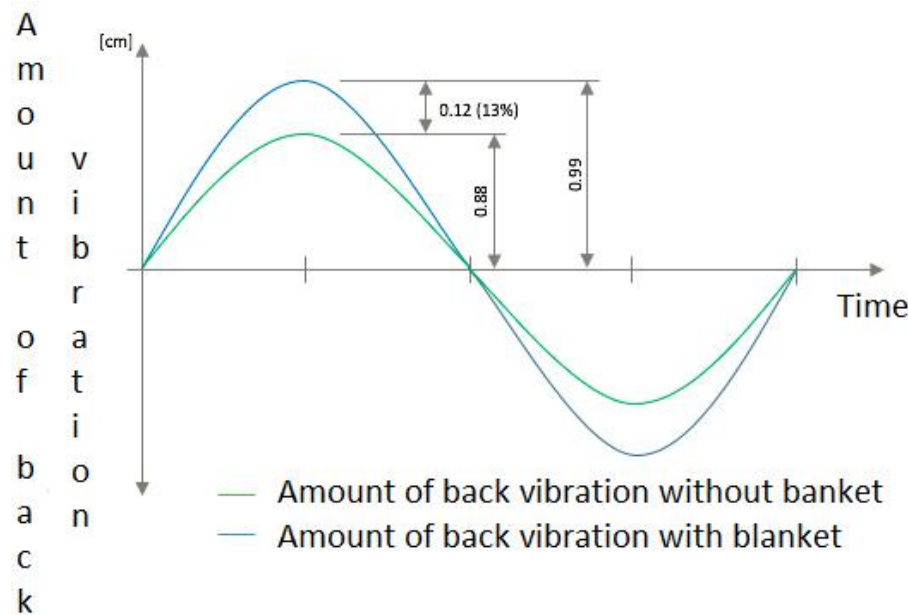


Abb. 24: Average vibration of the back

The results show that the massage blanket relaxes the back muscles. Since the spine is relatively static this means the vibrations stimulate the muscles. The blanket increased the back vibration by an average of 13% (Abb. 24)

It can also be concluded that the massage blanket effects different areas of the back in varying degrees depending on the horse.

A horse for example, has an easily released trapezoidal muscle, so I should therefore show the biggest change under the first point. For most of the horses, the rearmost value was the largest, meaning the horse swings the most there. This is presumably due to the fact that the hindquarters are almost exactly under the point – depending on the horse it can be a little more forward – step after step. The power from the hindquarters is mostly concentrated in his point.

The fact that the values differ for each horse and to differing degrees, it shows that there can be large differences between horses. Not every horse will get as strong an effect from the blanket.



Abb 25. Chiropractic back treatment

Afterwards, two horses were filmed and evaluated with a chiropractic examination. Here, one had a larger back due to the increase in back vibration, the other didn't.

This could be due to the fact the Chiropractor was busy with the back, which is mostly static. The back vibration was not affected by the treatment. Two days later the measurement was taken again, as the chiropractor said, the impact would show.⁷ However, the results were proven to be different. None of the horses showed any major difference.

It can be assumed; the massage blanket is ideal for horses with strained back muscles. But the blanket cannot fix any problems with the spine or vertebrae. If your horse has a spina problem, contact a chiropractor.

It is still not known if the length of the massage has an impact on its effect. In this study, the massage lasted approx. 20 minutes. Could a longer application have a major impact? According to the brochure, the blanket helps muscle building. This has not been confirmed. The measurements were made immediately after use of the blanket, but it is unknown how long the results last, one would have to take another measurement some time later.

⁷Veterinary chiropractor, Simone Suter

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10. Appendix I Test horses

Cassina AH

Gender: Mare

Age: 7 years

Breed: Holsteiner

Colour: Dapple grey

Height: 170cm



Abb.27 Cassina AH

Callista

Gender: mare

Age: 6 years

Breed: Holsteiner

Colour: dapple grey

Height: 180cm



Abb. 28: Callista

Calando

Gender: Gelding

Age: 13

Breed: Belgier

Colour: Brown

Height: 175cm



Abb. 28:
Calando

Chicoletto

Gender: gelding

Age: 8 years

Breed: Holsteiner

Colour: brown

Height: 165vm



Abb. 29: Chicoletto

ABC Piri

Gender: Stallion

Age: 15 years

Breed: Holsteiner

Colour: brown

Height: 165cm

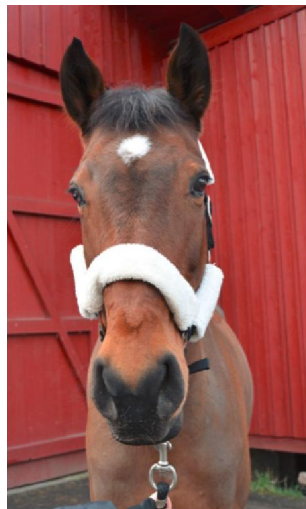


Abb. 30 ABC Piri

For Pleasures little boy

Gender: Gelding

Age: 10 years

Breed: holsteiner

Colour: Brown

Height: 175

Abb. 31: for pleasures
little boy



Appendix II Sketches and photos

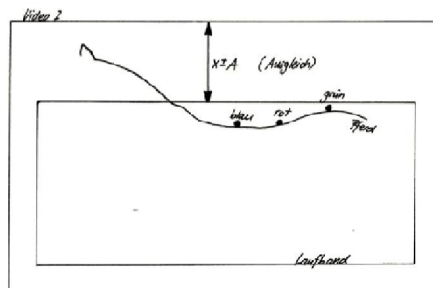
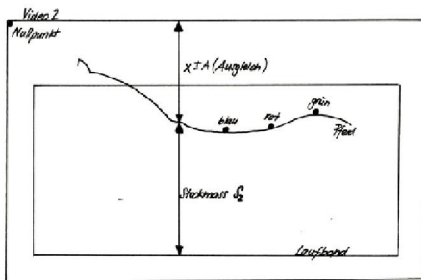
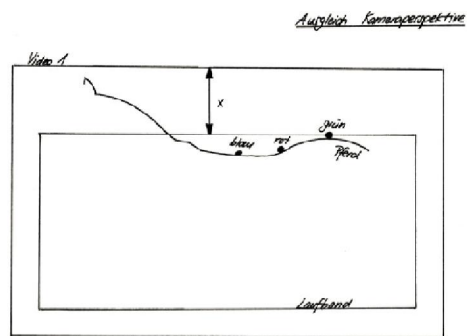
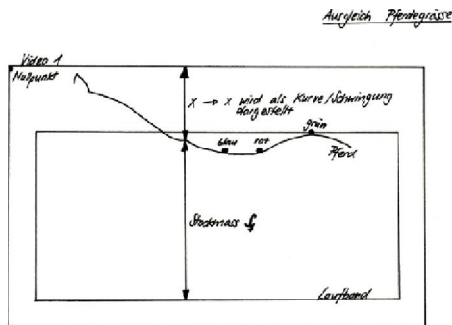


Abb 32: compensating Horse height

Abb. 33: compensating Camera position/angle

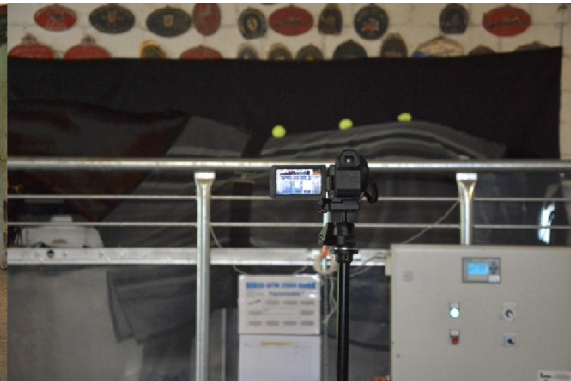


Abb. 34: Experiment set-up (test horse Qooper)

Abb. 35: Experiment set-up (test horse Qooper)



Abb. 36: Experiment set up (test horse Qooper)



Abb. 37: Experiment set up (tset horse Qooper)

13. Appendix III Equipment

Mounty Massage Blanket



Abb. 38: Mounty massage blanket ([www. Cavallo.de](http://www.Cavallo.de))

Dartfish Software

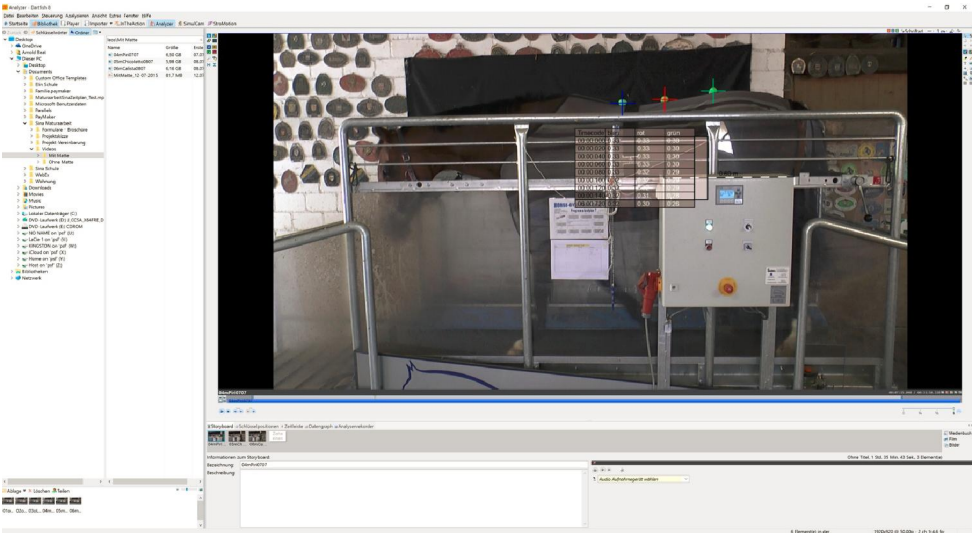


Abb. 39: Dartfish software

MATLAB evaluation software

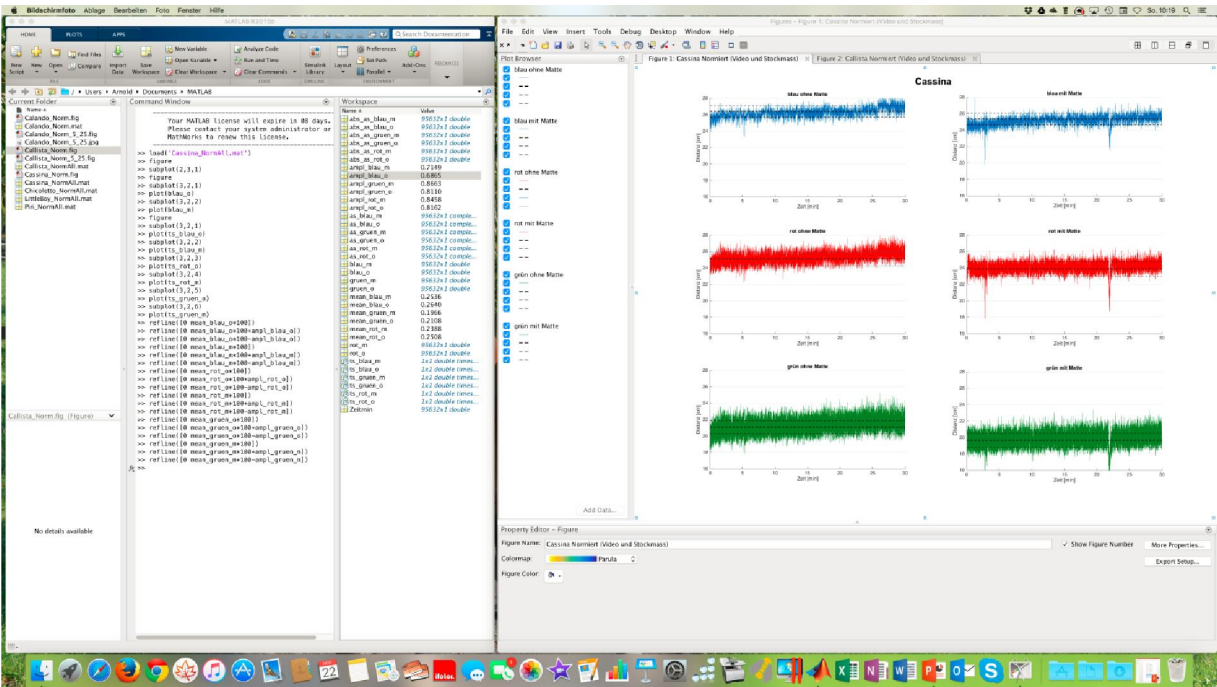


Abb. 40 MATLAB software

Treadmill



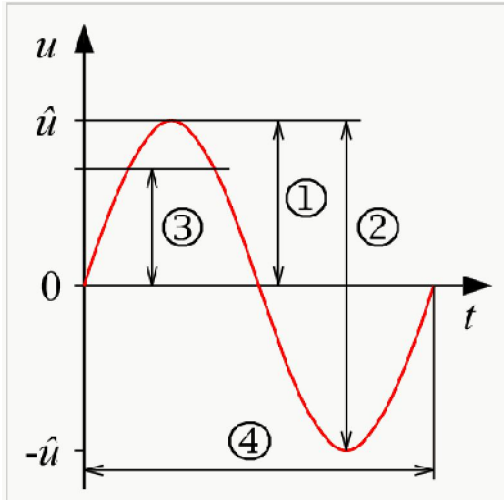
Abb. 41: Horse Gym treadmill 2000 DE (www.horse-gym-2000.de)

Video camera



Abb. 42: Video camera Panasonic HC-X909 (shop.mediamarkt.ch)

Appendix: IV Calculations



Sinusförmige Wechselspannung: 

- 1 = Amplitude,
- 2 = Spitze-Tal-Wert,
- 3 = Effektivwert,
- 4 = Periodendauer

Amplitude

The term Amplitude in physics is used to describe vibrations. It describes the maximum variation from the average.⁸

Amplitude spectrum

In the amplitude spectrum, the co-reduction of a signal from different frequencies is specified.⁹

Average

The average can be gathered from a multitude of situations. Usually, the value is calculated from two or more numbers.¹⁰

Abb. 43: Definition of Amplitude
(de.wikipedia.org/wiki/Amplitude)

Since the measurements off the horses back is not exactly defined as a vibration, the following calculation was used. This was discussed with an expert.

Calculating the mean amplitude

In order to calculate an average amplitude, the signals disassembled into their components, these could then be analyzed. This was done with the Fast Fourier Transformation (FFT). This creates an imaginary component, which then had to be removed. Once this was done, we had the amplitudes. In order to compare the whole time duration, the average amplitude was calculated for each signal.

We had to deal with more than 255000 values during these calculations, we used the METLAB software for this, as Microsoft EXCEL could not handle this amount of calculations.

⁸(de.wikipedia.org/wiki/Amplitude)

⁹(de.wikipedia.org/wiki/Frequenzspektrum)

¹⁰(de.wikipedia.org/wiki/Mittelwert)

Appendix V Diagrams

(note: the images are of graphs, but are too large to fit on the page and remain legible, they are readable in the original file. Below is the translation of the text on the graphs)

Distanz – distance

Zeit (min) – time in minutes

Mittelwert - average

Blau ohne Matte – Blue dot without massage blanket

Blau mit Matte – Blue dot with massage blanket

Rot ohne Matte – red dot without massage blanket

Rot mit Matte – red dot with massage blanket

Grün ohne Matte – green dot without massage blanket

Grün mit Matte – green dot with massage blanket

Autonomy and Consent

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Year / Graduation year: 6M / 2016

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