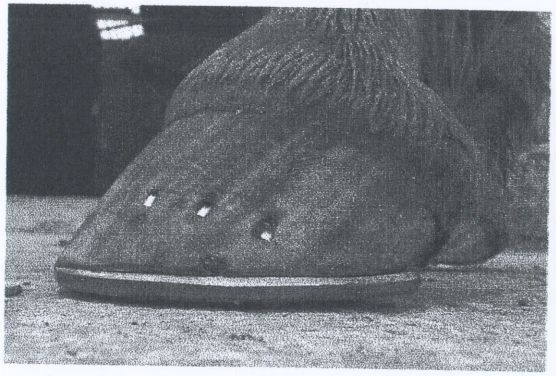
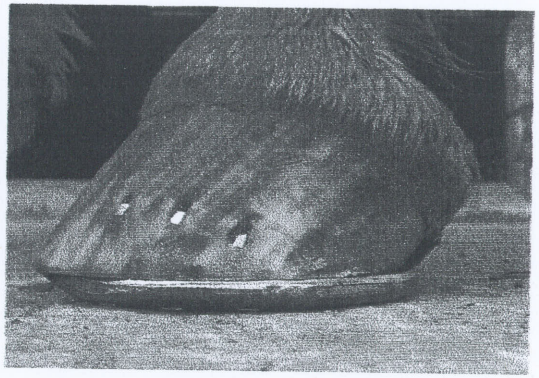
A.W.C.F.

Fellowship Thesis

2006

A Study Into The Effect of Reducing Break Over On The Gait Of The Horse





Douglas Angus Crawford A.W.C.F.

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INTRODUCTION

This study looks at reducing the break-over point and how it affects the horse's gait. The author has tried to answer some questions regarding modern trends by comparing them to traditional shoeing methods that have been in practice since the 18th century. Some critics say that the old methods are not in tune with today's horse and its requirements, and a need for an update is urgent.

The reason for this study was to research the theory that by moving the break-over point by 3/4 " towards the frog that this could be the difference between retirement or a new lease of life and prolonged career for some horses. The author was also intrigued to find out how this affects the limb in particular its dynamic state at walk and trot. The author has used this method on horses with a broken back hoof pastern axis for many years with immediate results e.g. preventing stumbling and creating and elevated freer gait.

In order to achieve consistency and repeatability, Natural Balance (NB) shoes were used in the study. The author was not trying to prove their efficiency in the treatment of any particular condition or endorse their use in the shoeing of all horses.

OBJECTIVE

This paper sets out to find if there is any difference at walk and trot, if any that altering the break-over point by 3/4 " would make to;

a) Stride Length at walk and trot.
b) Angle of the knee at walk and trot.
c) Position of the horse's limb at the point of break-over compared to conventional shoeing.

SUBJECTS

6 horses, heights from 16hh to 17hh, ages from 5 years old to 15 years old were chosen. All regularly competing in show jumping competitions to ensure they all have similar muscle tone for consistency in the research. This study was collated using video and the latest gait analysis software (Dartfish).

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HOOF PASTERN AXIS

An ideal HPA is considered to be when a straight line can be drawn through the proximal, middle and distal phalanges P1, P11, and P111, and that line is between 50 to 55 degrees to the ground.

A Broken Back HPA is when P111 is of less angles to P1 and P11.

There are different ways that this can happen:

1. Long toes and low heels
2. Week heels
3. Collapsed heels
4. Laminitis (Chronic Founder)

In the event of a flexural limb deformity the HPA can also be broken back when it is at the ideal angle as a tightening through the Superficial Digital Flexor tendon can cause P1 and P11 to be pulled to a steeper angle causing a deviation through the phalanges and creating a straighter angle through the fetlock joint.

The stance of the forelimbs tends to be underneath the body of the horse rather than 90 degrees to the ground. This type of conformation may also benefit from the break-over point being brought back in alignment with P1 and P11.

Break-over occurs as soon as the heel leaves the ground and rolls forward on to the toe; the forelimb is fully extended when the foot comes into contact with the ground. At break-over the limb changes from extension to flexion.

Similar studies on moving the Break over point have been researched:

Hilary Clayton - "Equine Locomotion"

"Break-over is the terminal part of the stance phase from heel off to toe off. Rotation of the hoof is brought about as a result of tension in the DDFT, and in the navicular ligaments. Farriery modifications that facilitate break-over may reduce tension in the navicular ligaments and also reduce pressure of the DDFT against the navicular bone. The onset and the duration of break-over are sensitive to changes in hoof balance especially hoof angle and toe length. Hooves trimmed with a low heel and a long toe have a significantly longer break-over time, although other stride variables like stride duration do not change significantly. On the other hand, rocker, rolled and square toe shoes did not significantly alter break-over time of horses trotting on a hard surface or on a rubber floor."

Alma Demille - "Natural Balance Shoeing"

"The first thing to understand is what happens to a horse when Natural Balance (Square Toed Shoes) is applied to his hooves. There are several things that change: As he moves, his break-over takes place sooner. The break-over is when the hoof rolls forward and leaves contact with the ground. This quicker break-over results in less stretching of the tendons, a change in the timing and path of the hooves' flight pattern, and in some cases changes the way the hoof wears and absorbs shock. In conclusion, I want to make it clear that whether using Natural Balance Shoes or making your own Square Toed Shoes, this is a very good method of correcting, preventing and treating certain problems and conditions. The whole reason I was motivated to write this article is that many of the farriers and horse owners who have switched over to this type of shoeing are doing so universally. They read an article about the benefits and got excited thinking it's the best thing for every horse. This is not true."

John C Alborough - "Veterinary Review on Holistic Treatment"

"Fixing steel shoes to a horse's feet, even in the most balanced and professional way, will have a massive impact. Cytek has been investigating this relationship for over 12 years and has made some respected equestrian Mary Wanless state in her book "For the Good of the Horse" (Kenilworth Press 1997) "That it is not surprising to discover that nature

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own central point of balance. In all gaits and at all times, while offering protection and support in the domestic situation. All horses, shod or unshod demonstrate that the point of most wear is at the toe. However, traditional horseshoes prevent the natural wear process and therefore toes become long. This creates stress within the hoof capsule. To understand the Cytek shoeing system it is important to grasp how a horse's hooves function in the wild. Studies show that feral and semi-feral herds that travel 30 to 40 miles a day across the rough terrain of Russia, Australia and other vast expanses do not suffer the recurrent lameness problems faced by domestic horses. What is also interesting is that the shape of their feet is markedly different. Under natural conditions, hooves adopt a strong, upright circular shape, with a thick sole and a wide frog. The point of break-over (the point at which the hoof turns over at the toe as it is lifted to take the next step) is much further back than in conventionally shod horses. Cytek shoes are fitted precisely, without adjustment and are a key point. Rather than the shoe being shaped to fit an already deformed hoof, all Cytek shoes operate in the same way, whatever the horses conformation or shape of the hoof capsule. That is, they all support the pedal bone and are positioned well back, allowing the horse freedom to follow his natural point of break-over (something conventional rim shoes prevent) and wear down his feet at the toe as he would in the wild, by enabling the horse's foot to function in much the same way as it would naturally.

Charles Heumphreus Memorial Lecture at UC Davis School of Veterinary Medicine

"The purpose of the blunt toe in the Natural Balance Shoe is to place the point of break-over within 1 1/8 to 1 1/4" forward of the apex of the frog. The foot is prepared much in the same way, as it would be if a conventional shoe were applied. What we learned was that by taking the toe back horizontally and therefore shifting the balance back as well as trimming the underneath so that the heel struck the ground just slightly ahead of the toe, this horse's flight of foot significantly improved and the stumbling problems diminished."

Simon Curtis - "Foal to Racehorse"

"Purely by placing a normal shoe on to the balanced foot of a horse, we unbalance it. The break-over point is moved away from the tip of the coffin bone and thereafter the relationship of the heel as the caudal point of support is altered."

In conclusion from the literature that has been reviewed, it seemed to be that by quickening the break-over, it did not have much significance in altering the stride length.

TOE MANIPULATION OF SHOES TO REDUCE BREAK -OVER TIME:

Rolled Toe Shoe
Full Roller Motion Shoe
Square Toe Shoe
Reverse Shoe

e that by
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R TIME:

SETTING

Heatherinch Farm, Ladybank, Fife.

STUDY GROUP

This study uses 6 horses, heights ranging from 16hh to 17hh aged between 5 years old and 15 years old. All were still competing regularly to ensure equal fitness.

HOOF CONFORMATION

It was important to have the 6 horses with a 50 degrees HPA using hoof protractors, and of similar size hooves, as the object was to find out the difference by comparison between conventional shoeing and a radically shortened point of break-over.

All the horses were shod with a conventional machine made shoe with upright heels 48 hours previous to being filmed, so that any hoof growth difference between horses did not influence findings between the two types of shoes.

It was important to use conventional machine made shoes for the study, as this would guarantee a consistency in size, weight, shape, balance and manipulation of the toe with all this in mind. The shoes used were Pledger 6" 7/8 3/8 with upright heels and NB 6" 7/8 3/8 for consistency in toe manipulation. Both shoes were weighed at 1 lb and 2 ounces; this again kept consistency throughout.

METHOD OF PREPARATION

The hooves of all the 6 horses were all 6" long from the point of the toe to the widest part of the frog. Before the conventional shoes were removed, a pen was used to mark a straight line across the widest part of the frog using the heels of the conventional shoe as an exact guideline. This guideline was then used as a reference point when fitting the NB shoes to ensure that both types of shoes had the same heel length, this was to try to ensure that the foot fall would be of similar timing on both occasions, making the only difference between the two shoes the reduction of the break-over point by 3/4 " from the point of frog.

ASSESSMENT AREA

A concrete area was used which was level and long enough for the horses to be assessed on (40 metres long). The same handler was used to encourage consistency and led all the horses. Markers were put down on the concrete to keep the horses in a straight line, as this was extremely important for the filming and measurements. All the horses were shown this area in advance to give them enough time to settle in and get used to the

DYNAMIC ANALYSIS

The camera used was positioned on a tripod three quarters of the way along the assessment area enabling the horse seven or eight strides to settle in to a rhythm before measurements were taken when in front of the camera.

The horses were walked up this area 3 times and 2 individual steps were measured each time. The two steps were then added together to create one stride measurement, then from the three stride measurements an average stride length was taken. This was also repeated at the trot. Each horse went through this process initially when shod the conventional way and then shod with the break-over point moved by 3/4 " towards the frog. When the horses were shod with the NB shoes they were allowed to become used to these shoes for at least 4 hours before filming commenced.

On the day, markers were placed on the horses' at the following points:

Fetlock Joint
Knee Joint
Elbow
Point of Shoulder

A marker was also placed on the body of each horse, which was 100mm long. This was required as a guide to enable the software for the video to gain an accurate reading. When the video was stopped at an appropriate frame the 100mm marker was measured first and set at 1 decimetre (100mm) then the rest of the measurements were carried out and the readings were given in decimeters.

The video was then run through computer software called Dartfish, which allows the video to be stopped frame by frame and various measurements can then be taken.

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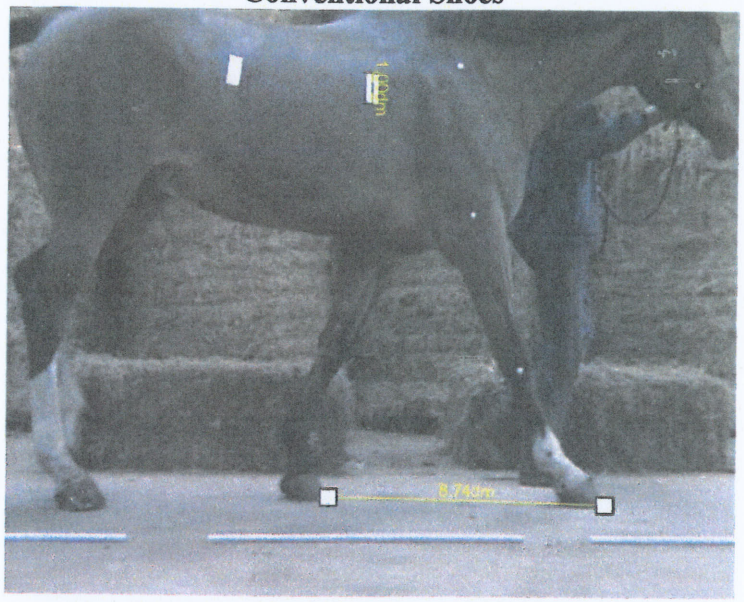
Study A The distance between stride length (toe point to toe point) was measured at both walk and trot with the horse shod with conventional shoes and then NB shoes.

Conventional Shoes



NB Shoes

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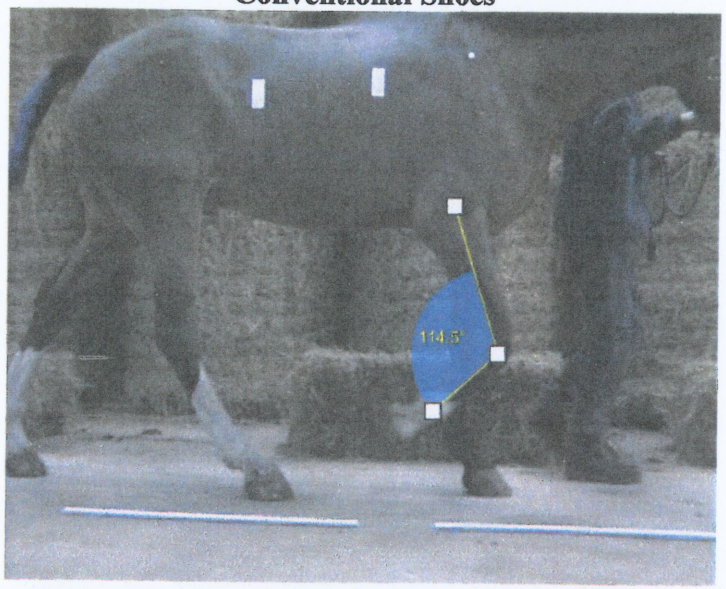
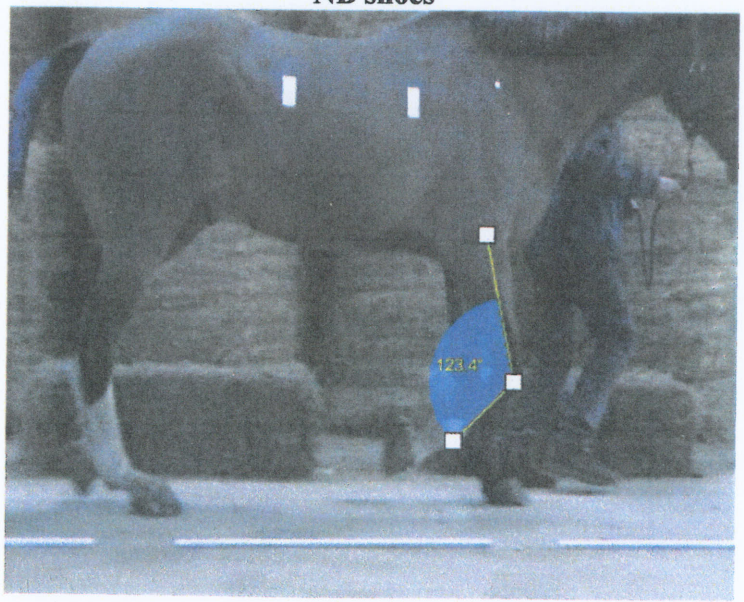
Study B The knee angle was measured at both walk and trot when the limb was at maximum flexion with both conventional shoes and NB shoes.

Conventional Shoes



NB shoes



limb was at

Study C The position of the horses limb at point of break-over was measured to see if any differences occurred between the two types of shoes.

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All 6 horses had 6 measurements taken at the walk with the conventional shoe and 6 measurements taken at the walk with the NB shoe. There were 3 measurements also taken on the knee angle at the walk. The same was done for these measurements at the trot. Each horse had a total of 30 measurements taken making a total of 180 measurements taken on the day.

STRIDE LENGTH AT WALK (STUDY A)

The information that I collected has been shown on the attached graphs showing the average stride length in the 6 horses varied, only 2 horses had a longer stride with the NB shoes fitted (Ben and Chester) and 4 horses had a shorter stride with the NB shoes fitted.

STRIDE LENGTH AT TROT (STUDY A)

I found that 2 horses had a lengthening of stride when fitted with NB shoes (Ben and Bobby) in comparison to the conventional machine made shoe, the other 4 horses had a shortening of stride.

ANGLE OF KNEE AT WALK (STUDY B)

These measurements taken have shown to be the most significant out of all the findings of this study, as it has shown to be 100% consistent with all 6 horses. There has been an increase in the knee angle of all the horses representing less knee bend when the NB shoes were fitted (see graph attached). I feel it is conclusive to say that by moving the break-over point by 3/4 inch towards the frog, it creates less pull on the Deep Digital Flexor Tendon and muscle creating less recoil hence less knee bend.

ANGLE OF KNEE AT TROT (STUDY B)

The finding of the angle of knee at trot was also 100% consistent as that of walk, in that all horses had an increase in the knee angle.

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(STUDY C)

Study C was introduced as further analysis on position of stride length relating to the horse's limb, as the stride length in Study A was not conclusive.

These measurements concluded that there was no significant difference between the NB shoe and the Conventional in both walk and trot in relation to the position of the horse's limb at the point of break-over. Some seem to have a shorter Measurement A (see attached) yet a longer stride and some had a longer Measurement A and a shorter stride.

It appears through these graphs and measurements that horses with a good HPA have a stride length that does not change a great deal with manipulation of the break-over point being moved ¾" but the angle of the knee being changed to a higher angle represents less knee bend in all horses.

All measurements in detail are included in ANNEX A.

A

n

Walk

Normal Shoe		
Step 1	Step 2	Stride
9.04	9.29	18.33
125.1		
9.24	9.74	18.98
129.5		
9.06	9.04	18.1
128.9		
e length		18.47
e angle		127.83

Natural Balance Shoe			
Walk	Step 1	Step 2	Stride
Stride Length	9.02	9.99	19.01
Angle of knee	131.7		
Stride Length	9.06	9.21	18.27
Angle of knee	131.6		
Stride Length	8.93	9.33	18.26
Angle of knee	133.1		
Average stride length			18.64
Average knee angle			132.13

Trot

Normal Shoe		
Step 1	Step 2	Stride
8.71	8.5	17.21
119.8		
8.21	8.93	17.14
114.4		
8.42	8.62	17.04
116.6		
e length		17.13
angle		116.93

Natural Balance			
Trot	Step 1	Step 2	Stride
Stride Length	9.8	8.55	18.35
Angle of knee	116		
Stride Length	8.49	9.46	17.95
Angle of knee	125		
Stride Length	8.74	8.51	17.25
Angle of knee	115.2		
Average stride length			17.85
Average knee angle			118.73

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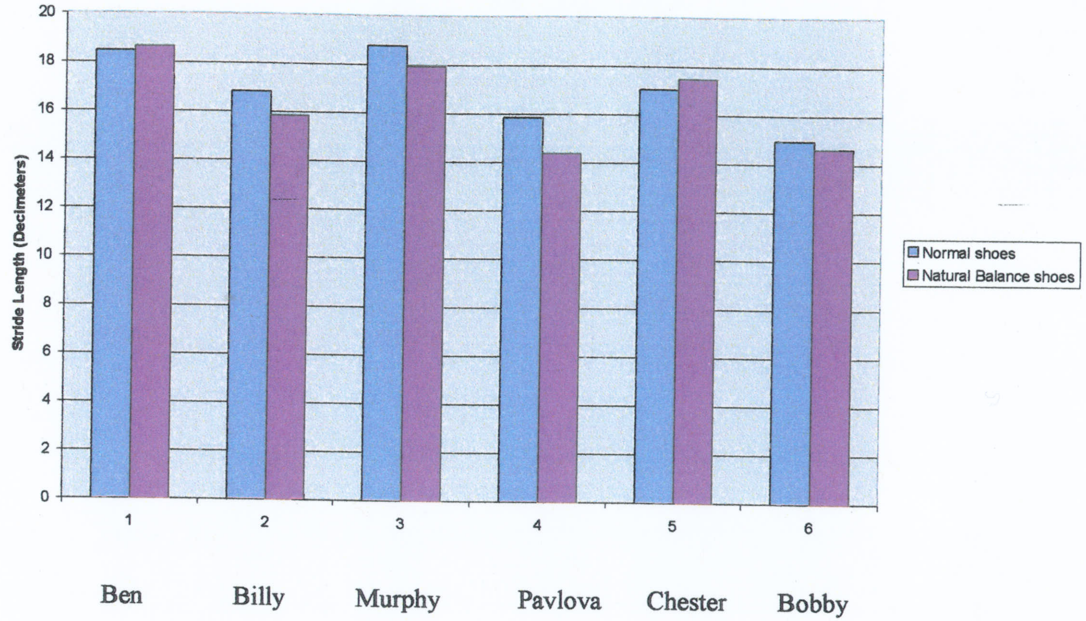
Study A

Results taken at Walk

Stride length



The above graph shows two horses had a lengthening of stride when fitted with NB shoes in comparison to the conventional machine made shoes Ben (by 17 mm) and Chester (by 44 mm) the others showed a shortening of stride Billy (97 mm) Murphy (85 mm) Pavlova (147mm) Bobby (33mm)

Normal shoes
Natural Balance shoes

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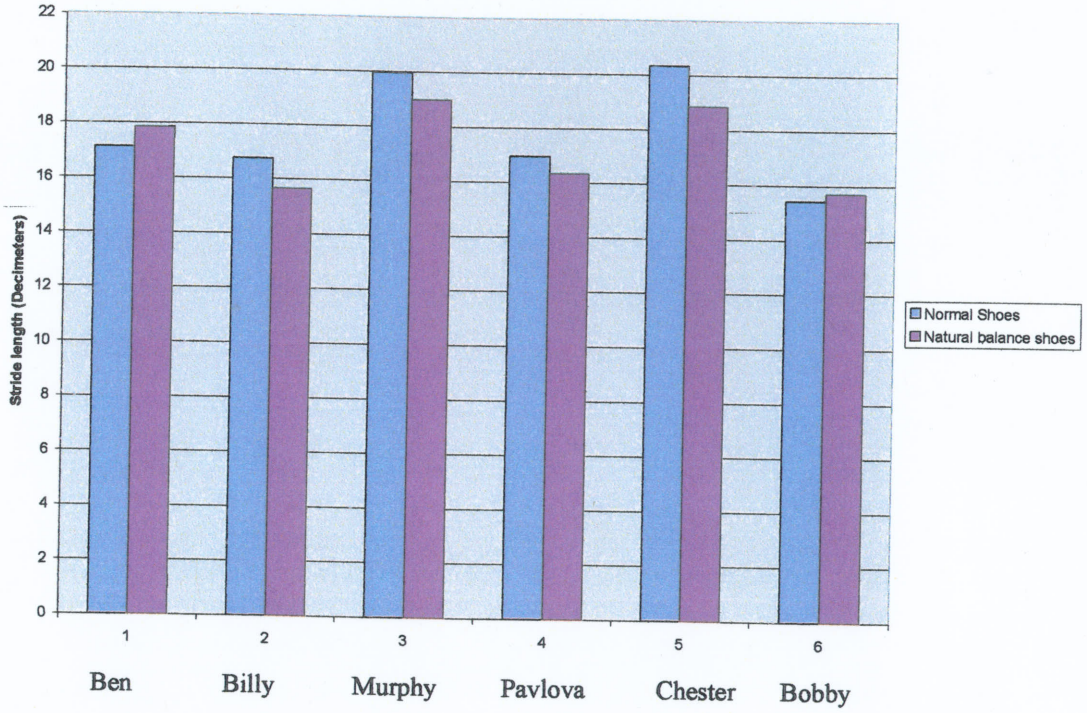
(85 mm)

Study A

Results Taken At Trot

Stride Length



The above graph shows two horses had a lengthening of stride when fitted with NB shoes in comparison to the conventional machine made shoes Ben (by 72 mm) and Bobby (by 26 mm) the others showed a shortening of stride Billy (109 mm) Murphy (99 mm) Pavlova (61mm) Chester (147mm)

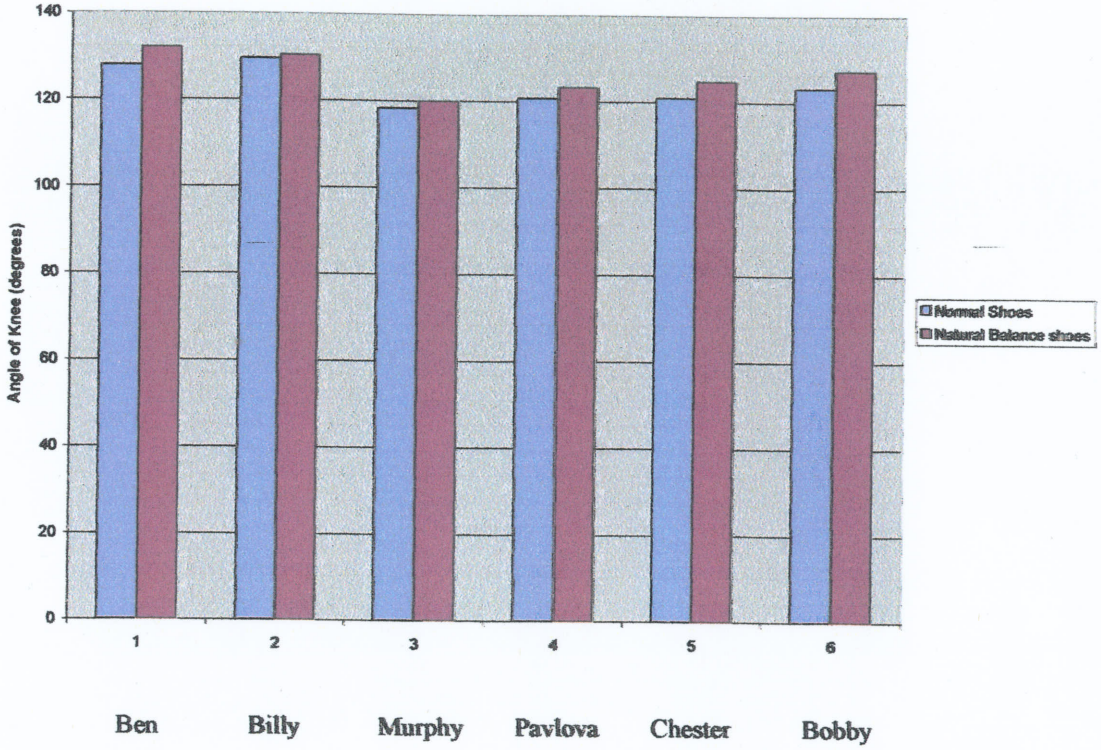
Normal Shoes
Natural balance shoes

with NB shoes
nd Bobby (by
(99 mm)

Study B

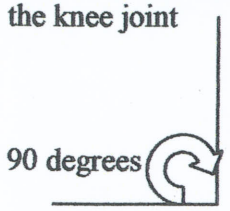
Results Taken At Walk

Angle Of Knee



The above graph shows that all the horses fitted with NB shoes had an increased angle of knee which equates to less flexion of the knee.

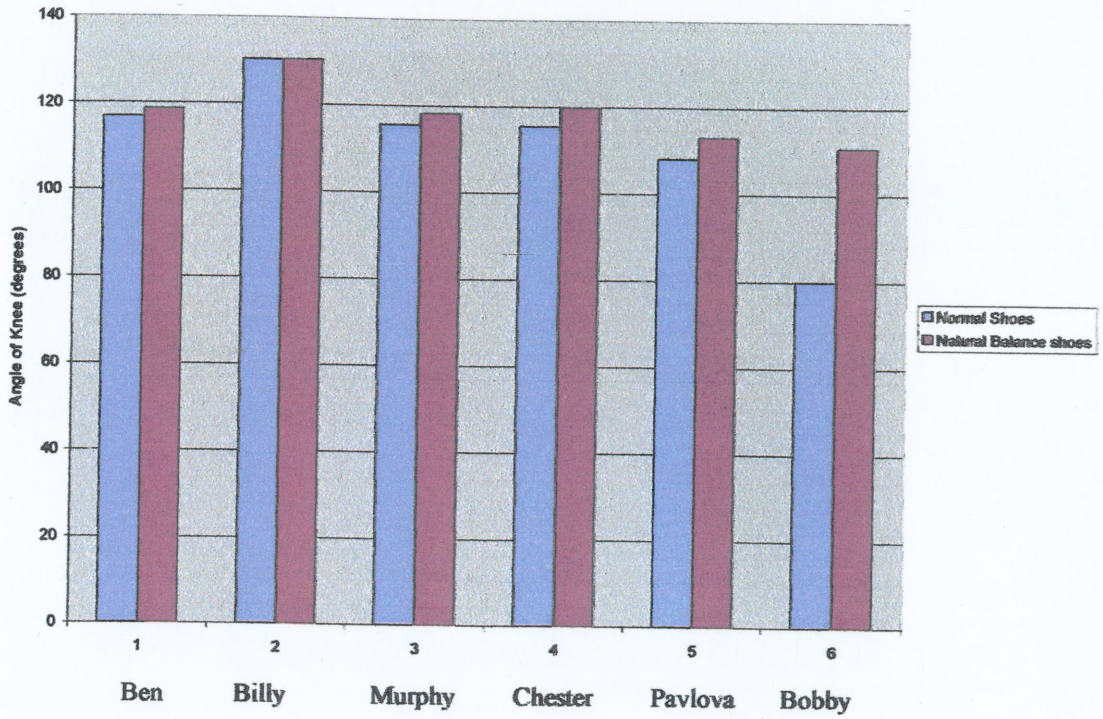
The schematic diagram below shows how an increase in angle represents less flexion of the knee joint



These measurements represent the difference in the angle of the knee between the conventional machine made shoes and the NB shoes. Ben (4.3 degrees) Billy (0.87

Results Taken At Trot

Angle Of Knee



The above graph shows that all the horses fitted with NB shoes had an increased angle of knee which equates to less flexion of the knee.

The schematic diagram below shows how an increase in angle represents less flexion of the knee joint

These measurements represent the difference in the angle of the knee between the conventional machine made shoes and the NB shoes Ben (1.8 degrees)

Normal Shoes
Natural Balance shoes

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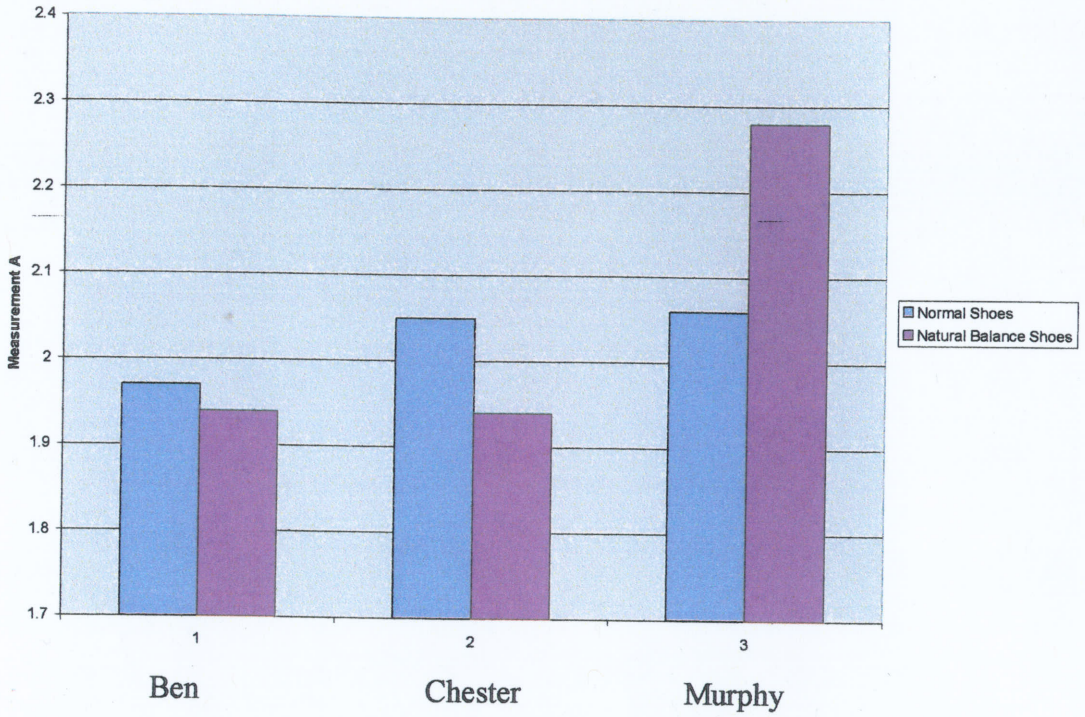
Results of Study C

Walk



This graph represents the measurements taken (ref. photo 6 Material & Methods) and shows the difference between measurement A when the horses were shod with conventional shoes and NB shoes.

Murphy had a longer measurement A with the NB shoes on by 22mm whilst Ben had a shorter measurement by 3mm and Chester had a shorter measurement by 11mm.

Normal Shoes
Natural Balance Shoes

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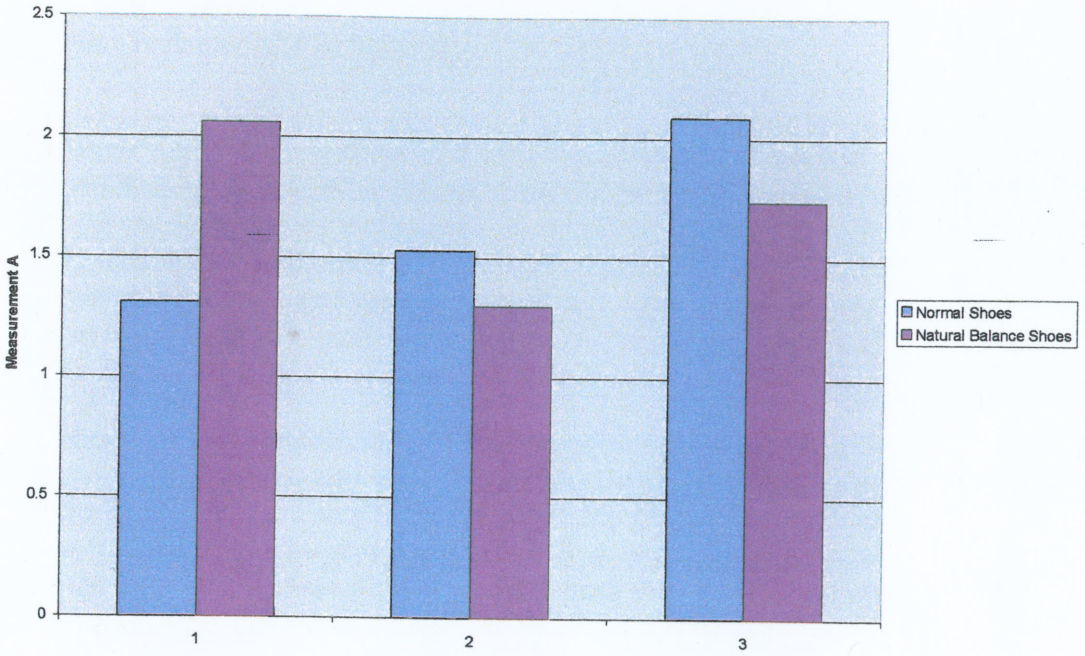
Results of Study C

Trot



Ben Chester Murphy

At the trot Ben had a longer measurement A with the NB shoes on by 75mm whilst Chester had a shorter measurement by 23mm and Murphy had a shorter measurement by 36mm.

DISCUSSION

The first evidence that the author started to gather was that of horses that had Broken Back Hoof Pastern Axis (HPA). These horses had problems stumbling when going uphill and also going short when coming downhill. At this stage a number of them were shod by moving the break-over point by ¾" back from the original point of the conventional shoe. The hooves were assessed, trimmed and balanced to the HPA and Tee Square both medially and laterally.

In particular, one of these cases was of a Police horse that was forced to retire because of constantly stumbling and falling on to its knees, causing a danger to rider and animal itself. He was handed over to the ILPH rescue centre where he was adopted by a vaulting yard to be used by them, but it was soon apparent that the problem was not going to go away and he could not be used for vaulting. I put into force a shoeing plan and the horse has now become the perfect vaulting horse and regularly competes all over Great Britain.

The author's own experiences with NB shoes have found that used on horses with a broken back HPA that the shoe creates the natural break-over point without distorting the toe of the hoof capsule. Since NB shoes lessen the amount of stretching on tendons, then it stands to reason that a horse with bowed tendons or pulled muscles associated with this part of the body's movement will benefit from such shoeing. Horses with hooves that are long from heel to toe are obvious benefactors of NB shoeing as the square toes make up for the poorly shaped hooves.

Benefits of having such an accurate analysis enable us to highlight even minor changes, which may in the short and long term, benefit the performance of the horse.

The author feels that in this particular case that this type of shoeing played a large part to the success of the horse.

(See attached Photographs A & B)

Photograph shows the horse with a Broken Back HPA with excessive toe growth. The break-over point has protruded the straight line through P1 and P11 creating a delayed break-over point and extra strain on the Deep Digital Flexor Tendon at last point of break- over (This horse was very prone to stumbling).

PHOTOGRAPH B

Photograph B shows the same foot as Photograph A after the HPA has been assessed and trimmed to the HPA. A NB shoe was fitted creating a shorter break-over point by 1 ½".

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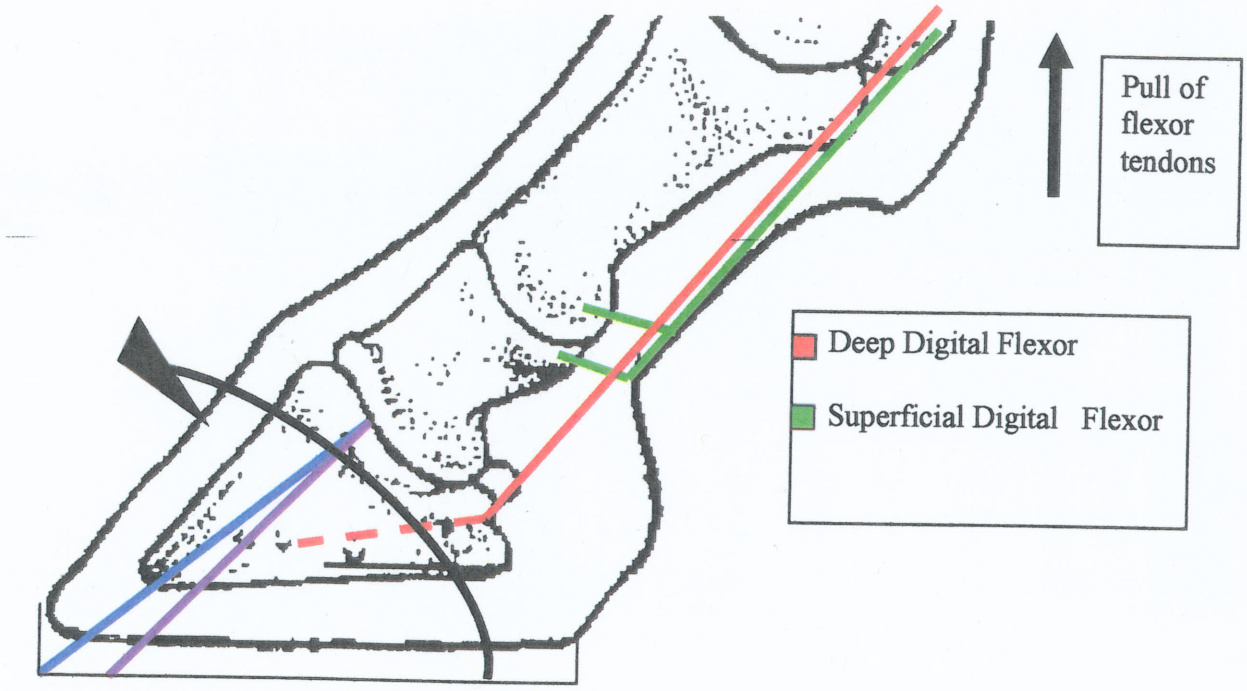
Photo A

Photo B

Mechanical change between conventional shoes and natural balance shoes



This diagram shows how the biomechanics within the limb are altered by the application of an NB shoe. The effort required by the flexor muscles/tendons is decreased by virtue of having to flex the limb over a shorter lever arm, supporting the findings that the angle of the knee increases when NB are fitted. This will also aid in the prevention of stumbling.

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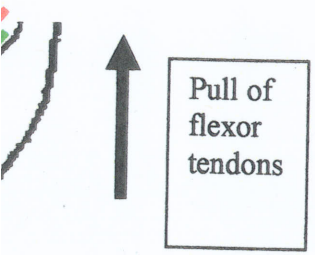

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CONCLUSION

As all measurements in this study were taken in a dynamic state, I found no major difficulties in consistency through the handler or the horses' impeding the gait of the horse. When going on a hard surface like the concrete used, it should be noted that the break-over is delayed to the maximum, thus the stride lengthens, the action is somewhat lower (flatter) and the break-over stress increases.
(ref : horsemanpro.com/articles/break-over)

The selections of the horses were crucial to the true findings of the study, as they were all of the same HPA (50 degrees) to enable similar flight pattern.

On looking into the results I found that the 2 horses that had a longer stride at walk and trot seemed to be horses who walked smartly and were keen to move beside the handler. This did not affect the final results on the day.

After results were collated, by altering the break-over point by ¾" in relation to:

a) STRIDE LENGTH

This result was quite surprising as the author thought that altering the break-over point would affect the stride in all the horses in the same manner, this was not so.

b) ANGLE OF KNEE

In this result all horses were affected in the same manner. Assumptions before the trial were that there may be an increase on knee bend but instead it had a decrease on the knee bend. This might have been because the conventional shoe maybe creating a higher knee bend as it has a longer leaver to break over.

c) POSITION OF THE HORSE'S LIMB AT POINT OF BREAK-OVER

In this study there was no significant difference. The author thought he would see a shorter distance from point of break over to the 90 degrees line to the position of the limb as the break-over should have occurred earlier.

Ref : Hilary Clayton - Equine Locomotion.

"On the other hand, rocker, rolled and square toe shoes did not significantly alter break-over time of horses trotting on a hard surface or on a rubber floor."

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2. **Foal to Racehorse (Simon Curtis) 1999, Newmarket Farriery Consultancy**
3. **Natural Balance Shoeing (Alma Demille)**
4. **Veterinary Review (John C Alborough)**
5. **UC Davis School of Veterinary Medicine (Charles Heumphreus)**

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