



The
Open
College of
Equine
Studies

Taster Pack:

Level 6 Equine Physiotherapy Diploma
Programme



IRVAP

Taster Pack: Level 6 Equine Physiotherapy Diploma Programme

Thank you for your interest in the Level 6 Equine Physiotherapy Diploma Programme. We hope that you choose to study with us, and we thought you might enjoy a few activities to give you a taste of what to expect on this course.

Completion of this pack is not mandatory, but it would help your knowledge and understanding and will also help you to prepare for your studies with us.

Video links are provided throughout this pack. You should make notes whilst watching the videos and then complete the learner activities provided.

Level 6 Equine Physiotherapy Diploma Programme

Introduction

A working knowledge of biomechanics is essential to allow the equine practitioner to effectively carry out his or her role. A comprehensive understanding of the way in which horses function is fundamental in analysing movement patterns which may be used as an indicator of required treatment or therapy.

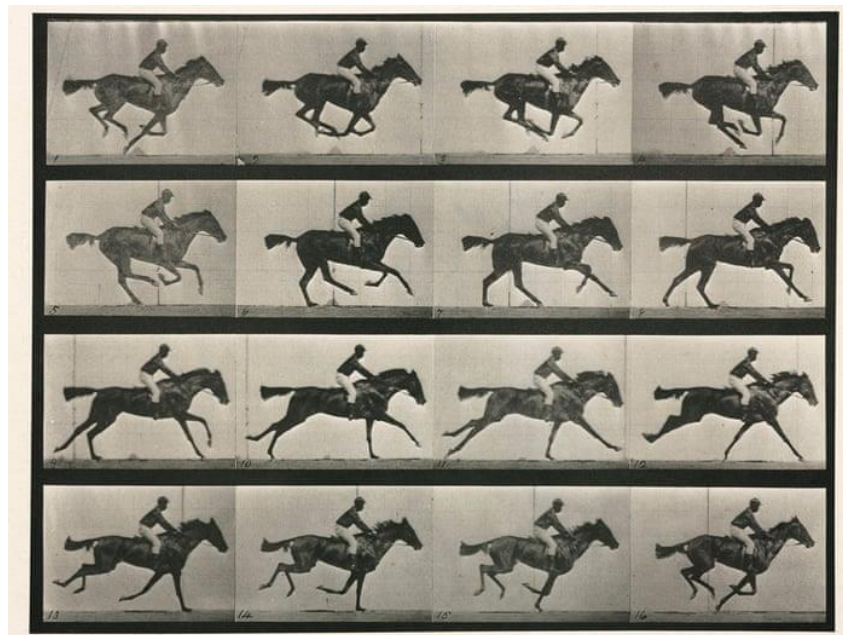
This taster pack focusses on the principles of equine locomotion and methods used to assess movement of the horse.

A brief history of equine biomechanics research:

Biomechanics research with horses really began with the seminal work of Eadweard Muybridge in 1887 that stimulated interest in the discipline with remarkable photographs of equine movement. It was Muybridge who first discovered using his photographs that in the trot gait there was an actual period of suspension when no feet were on the ground at all. Click or scan the QR-code to view a video which gives a little more information about Muybridge and his work.



The series of photographs generated by Muybridge are world-renowned and revolutionised our understanding of way in which the horse moved. The photographs, when viewed in quick succession, appeared to show the seamless movement of the horse at the various gaits. The gallop is shown below. The photographs can be viewed in a loop [here](#).



However, this brief flurry of research activity into equine biomechanics ground swiftly to a halt when the general use of the horse was replaced by steam and motor power. The number and use of horses declined dramatically as man turned his attention to greater providers of horsepower.

A revival of interest began in the 1970s with the introduction of the concept of the 'sport horse' and the advent of cheap computer power, and since that time the scientific discipline of equine biomechanics has come of age.

In recent years there has been an increase in the use of equine biomechanics, particularly in relation to the sports horse and evidence-based sports science. Click or scan the following QR-code to watch a short video which reviews contemporary use of biomechanical analysis in equestrian sport.



Learner activity: application of knowledge

Using your existing knowledge and the information given so far, outline two scenarios in which you feel that an equine biomechanist might be of use to the owner/rider/trainer of a horse.

Outline:

- a. Types of irregular movement patterns that you can see in sport horses.
- b. How do you think these irregular movement patterns may affect the horse's performance?
- c. How do you think these irregular movement patterns may affect the horse's resilience to injury?

Provide your responses below. *You may also use the TOCES study notes provided later in this pack to help you.*

Response a.	
Response b.	
Response c.	

"Developing an eye"

Irregular movement patterns, as mentioned above, can present in many different ways and can predispose to many different injuries. It takes time and practice to develop the ability to objectively assess equine movement. Below are links to three contrasting videos. Watch each of the videos and provide brief notes on the movement patterns you see. You should consider both positive movement traits, and also deficits in movement which may be considered undesirable.

Don't worry if you're unsure of what to write, or you don't feel that you can provide a great deal of information; this can be used as an indicator of your current level of knowledge.



Further reading

Having watched the videos, you may now appreciate the importance of trotting the horse up correctly so that movement can be properly observed. The following article from Horse and Hound reviews correct procedures for trotting up. It is important to take note of this when trotting up for a lameness work-up, gait analysis, or conformation analysis. You can view the article [here](#).

Sample TOCES Material:

You may use this to help you to complete the learner activities in this pack.

ASSESSMENT OF EQUINE LOCOMOTION

Mechanics can be sub-divided into two broad categories: **KINEMATICS** and **KINETICS**.

Kinematics is the science that concerns the description of motion, e.g. the way body parts are being moved through the air. Kinetics is the science of motion causation and primarily involves the study of measurement of the **FORCES, MOMENTS** and **TORQUES** which cause motion.

In effect kinematics is purely a descriptive discipline whilst kinetics is concerned with mechanisms. It is the combination of these two categories that accounts for locomotion and this combination is generally referred to as **KINESIOLOGY**.

Do not confuse this term with the laying on of hands to diagnose injury or illness practiced by some “therapists”. Although the techniques have the same name they are about as far removed from each other as you can get.

Introduction to kinematics - equine dynamics

Kinematics, as we have said, is the study of spacial movement and is the branch of mechanics that deals with locomotion. Kinematics in equine biomechanics is a very important discipline because we still select horses subjectively for gait and conformation. Therefore, if we can characterise **OBJECTIVELY** what we are looking for then we have a firm foundation for selection based on those criteria.

Kinematics as a discipline can itself be divided into two sections: **LINEAR** and **ANGULAR**. Linear kinematics is defined as the “motion of a body when all parts of the object move through the same distance in the same time period”. Angular kinematics is defined as “objects or bodies which undergo rotation”.

The most important principle to understand is that motion can be analysed as an independent combination of linear and angular motion. For example, when a footballer kicks a football, not only does the entire football move through the same distance in the same time period (linear), but it also spins around its centre of mass (CM) (angular). These two kinematic variables can be analysed independently of each other and the effects of one upon the other can also be determined. This means that any kinematic problems can be divided into two smaller problems.

Although these two smaller problems are easily solved when looking at footballs or other similar objects, three-dimensional analysis of the horse represents a far more complex structure and researchers have divided the equine body into “segments” and the linear motion, the CM and the rotation about the CM of each segment must be known. We have already seen what a complex problem CM in the horse represents.

For this reason, most of the equine kinematic research to date has revolved around two-dimensional analysis which was a good place to start. We must learn to walk before we can run and even an appreciation of two-dimensional equine movement is better than no appreciation at all. For a two-dimensional analysis of equine movement we can virtually discount CM and reduce the problems to their very basic states.

Two dimensional analyses however, can yield very important information such as normal range of joint angles in all gaits and movement of body parts through space. For example, in his seminal work on the development of equine locomotion¹, Dr Willem Back used 2-D analysis to measure the changes in joint angles and limb movement in 28 horses starting when they were 3 months old and concluding when they were 30 months old. We will look more closely at this work later but Willem Back was able to demonstrate that you can predict how foals will move as adults by analysing their movement patterns at 6 months old. Just think how valuable this information would be as a performance predictor in young stock, especially if you had the movement template of elite performers.

For example, if we could quantify the inherent movement patterns of grand prix dressage horses we could compare them to the movement patterns of our 6 month foals and KNOW which ones had the basic foundations of the elite performer. Now we begin to appreciate the benefits that knowledge of equine biomechanics could yield.

ITQ Complete the sentence:

Mechanics is divided into two categories. Kinematics is the study of
..... and Kinetics is the study of

..... Kinetics involves the measurement of

(1) (2) (3)

¹ Back. W. (1994) Development of Equine Locomotion from Foal to Adult. PhD Thesis University of Utrecht, Netherlands. ISBN 90-393-0564-1

Anatomical nomenclature

There is a specialised nomenclature that we need to understand regarding assessment of equine movement. All of these definitions are taken from a book known as the **Nomina Anatomica Veterinaria** which standardises veterinary definitions throughout the world so that when a particular word is used, there will be no misunderstandings.

Anatomical nomenclature is generally related to positional adjectives – words which describe whereabouts on the body a particular body part can be found. These can be very confusing to the everyday horseman more used to terms such as near, off, front, back etc. Figure 20.9 shows some of the more common terms.

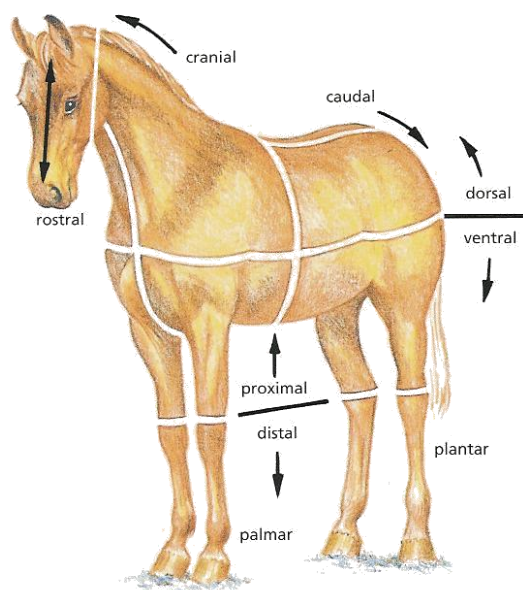


Figure 20.9 Common terms in anatomical nomenclature.²

Some terms are common to all areas of the body. Deep and superficial indicate relative distances from the outside of the body; medial and lateral give the position nearer to or farther away from the midline of the body.

Limbs

In the limbs, **proximal** relates to that part of the limb towards the topline whilst **distal** refers to the part towards the hoof. The terms proximal and distal have no anatomical points as such. For example, the distal sesamoid is another name for the navicular bone whereas the proximal sesamoids are behind the fetlock. They are so named because the proximal sesamoids are closer to the topline than the distal sesamoid.

Dorsal is that part of the limb below the knee or hock facing towards the front. **Palmar** is that part of the front limb below the knee facing the rear. **Plantar** is that part of the hind limb below the hock

² From: Williams, G.E. and Deacon, M. (1999) No Foot No Horse: Foot balance – the key to soundness and performance. Kenilworth Press.

facing the rear. For example in the front limb the deep digital flexor tendon is dorsal to the superficial digital flexor tendon but palmar to the cannon bone.

Cranial is the equivalent of dorsal in the proximal limb whilst **caudal** is the equivalent of palmar/plantar in the proximal limb.

Body

Dorsal refers to positions nearer to the topline whilst **ventral** refer to positions nearer to the floor of the thorax. **Cranial** means towards the head whilst **caudal** means towards the tail. In the head, however, the part towards the ears is caudal but the parts towards the nose are known as **rostral**.

Limb pairs

When we are referring to limbs then the front limbs are known as the **pectoral limbs**. When referring to the hind limbs we talk of the **pelvic limbs**. As an Equine Biomechanist you must get out of the habit of referring to “near” and “off” legs. This terminology is seriously frowned upon and so we have the right and left pectoral limbs and the right and left pelvic limbs.

There are six combinations of limb pairs (two within each definition). First there are the **diagonal** pairs – the left diagonal pair and the right diagonal pair. Just to make it confusing, equestrians name diagonal pairs according to the pectoral limb – for example the left pelvic and the right pectoral together are known as the right diagonal – but Equine Scientists name diagonal pairs according to the pelvic limb. In this way the left pelvic and the right pectoral are known as the left diagonal.

The second combination is the **ipsilateral** pair. This refers to the pectoral and pelvic limbs on the same side. The left ipsilateral pair is the left pectoral and left pelvic limb pair, whilst the right ipsilateral pair is the right pectoral and right pelvic limb pair.

The third combination is the **contralateral** pair. This refers to the pair of pectoral limbs – being the pectoral contralateral pair, and the pair of pelvic limbs – being the pelvic contralateral pair.

Limb movement

During locomotion, each foot is either on the ground or moving through the air. When the foot is on the ground it is known as the **stance phase** and when the foot is in the air it is known as the **swing (or suspension) phase**.

ITQ Insert the correct positional adjectives.

The wither is	to the pelvis
The wither is	to the elbow
The common extensor tendon is	to the cannon bone
The carpus is	to the hoof
The sternum is	to the vertebrae
The nostrils are	to the ears
The ears are	to the nostrils
The navicular bone is	to the coffin joint

Midstance position in the front limb is defined as the instant within the cycle of limb movement when the metacarpal (cannon bone) is vertical. In the hind limb, midstance is defined as when the hoof is vertically aligned beneath the hip joint. Neither of these are temporal measurements - you do not take the time that the hoof is on the ground and divide it by 2. If you did this then you would not be able to calculate if a particular horse had a shortened cranial or caudal stance phase. By defining a particular anatomical configuration not only can you make meaningful comparisons between horses but you can also look at changes to the stride brought about by such extrinsic factors such as training, shoeing etc.

Close packed position is the term applied to the anatomical configuration of joints when the limb is in the midstance position.

A **symmetric gait** is one where the footfalls of the contralateral limb pair are evenly spaced in time. Therefore horses' symmetrical gaits are walk, trot and pace. An **asymmetric gait** is one where the footfalls of the contralateral limb pair are unevenly spaced in time as in the canter and gallop. This is because there is a large suspension phase in the canter and gallop.

A **stride** is a complete sequence of limb movements. This is measured differently according to whether the gait is symmetric or asymmetric. In symmetric gaits the stride is measured from the placement of the left hind until the subsequent placement of the left hind. In asymmetric gaits the stride is measured from the placement of the non-lead hind to the subsequent placement of the non-lead hind.

Stride length is formally defined as the distance travelled by the CM during one stride. Obviously owing to the difficulties associated with CM, practically stride length is measured as the distance between the footfalls of a designated limb.

Stride duration is the time required to complete one stride. **Stride frequency** is the number of strides per unit of time – usually strides per second.

Overlap is the time when part or all of the stance phase of one limb occurs concurrently with that of another limb.

Advanced placement/advanced lift-off. You may see this referred to as disassociation. It refers to the time span between subsequent footfalls or footlifts.

You may be able to get a better grasp of these meanings by referring to Figure 20.10 on page 18.

The next step...

We hope you enjoyed completing this pack and that you feel you have learned from it. Course material is designed and reviewed by a team of qualified experts and is presented in a user-friendly distance learning format, in print and/or online. The friendly team at TOCES is dedicated to providing you with the best levels of advice and support; office and tutorial staff are available to assist you at all reasonable times via telephone and e-mail.

There are many courses on offer at TOCES, ranging from those who are complete newcomers to horses, to specialist diplomas and equine higher education distance learning programmes.

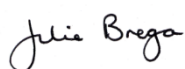
Whilst TOCES offers a greater range of courses, is highly professional and is associated with more world-renowned equine organisations than any other equine distance learning college, we are proud of our reputation of having a friendly and personal approach with our students.

Comprehensive range of courses + flexible delivery mode + full tutor and administrative support = a great learning experience.

Please don't hesitate to get in touch if you have any questions or would like further information.

We hope you choose to join us!

Best wishes



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