



An image to demonstrate how the croup of the horse (the highest point of the hind end of the horse's back) 'displaces' in a vertical plane when trotting on an aqua-treadmill.

Vertical displacement of the croup

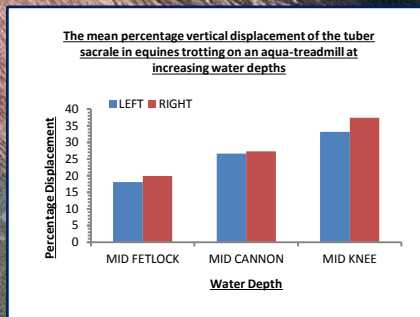
During data collection it was important to ensure that the water depth was measured accurately for each horse.



When compared to the work that has been carried out in humans, currently, there is only a very limited amount of equine hydrotherapy research. Specifically, little research has been conducted on the equine aqua-treadmill so this current research has focussed on quantifying the movement of the horse on the aqua-treadmill to accurately determine the effects and potential benefits of aqua-treadmill exercise.

Data has been collected by tracking three-dimensional coordinates of anatomical landmarks on the horse's back using both optical motion capture systems and inertial sensors. Horses were put through a set exercise protocol that included both walking and trotting through different depths of water to quantify the movement and identify patterns of symmetry. It is anticipated that an optimal water depth and exercise protocol may be determined to best promote rehabilitation and therapy methods in the individual equine athlete.

From simply focussing on one anatomical landmark on the horse's back it has been possible to determine that as the water depth in the aqua-treadmill increases so does the amount the horse lifts itself upward to move.



This graph shows data from a specific anatomical landmark on the horse's back – the *tuber sacrale* or the *croup*. This is the highest point on the hind end of the horse's back and as such provided the most obvious point to study initially. Data was collected in three planes and this graph focuses on only the vertical movement, calculated as a percentage increase from the baseline level which was water just at the height of the hooves. Fetlock, Cannon and Knee are higher points up the horse's leg from the hooves and were a standard measure in which to control the depth of the water. There are two parts to the trot stride; left and right, and the graph shows that the stride became most asymmetrical when the depth of the water was at the height of the mid point of the horse's cannon.

WALKING IN WATER

EQUINE HYDROTHERAPY

Hydrotherapy is a branch of physiotherapy that has been long recognised for its benefits. Historically, ancient civilisations are documented to have used hydrotherapy for its physical benefits, notably the use of hot spas and baths in roman times, and the Greek philosopher Hippocrates is reported to have recommended hydrotherapy for the relieving of medical conditions (Jackson, 1990). In more recent times, Charles Darwin recognised that he would not have lived long enough to publish his famous work 'On the Origin of Species' without the hydrotherapy, water cure and homeopathic treatments that he himself underwent for his own health, although he was reluctant to admit the benefits of these alternative therapies for fear of his major works not being taken seriously (Ullman, 2009). Hydrotherapy specifically involves therapeutic exercise in the form of swimming or walking (Prankel, 2008). In humans, aquatic exercise has been used extensively in rehabilitation where there is evidence to suggest that exercise in water is preferable to land exercise for patients suffering from orthopaedic disease, and that aquatic therapy may aid ease of movement, swelling reduction and pain relief, due to the pressure and temperature of the water (Hinman *et al.*, 2007), and positive effects of the water buoyancy and water resistance (Denning *et al.*, 2012). In canines, the recognition of the importance of rehabilitation after injury has grown which has resulted in Veterinary Surgeons consulting with trained therapists in order to put together specific rehabilitation programmes for each animal (McGowan, 2007, p.187) to attempt to rehabilitate the animal in a more thorough way so that there is less chance of a repeat injury or an injury occurring elsewhere before the animal is fully fit.

Increasing the depth of the water in the aqua-treadmill to intensify the physical demands of the exercise maintains the horse's pattern of movement symmetry and specific depths of water appear to have a more positive effect on movement symmetry. Having knowledge of how a horse moves on an aqua-treadmill is vital for tailoring specific therapy treatment programmes in order to most successfully rehabilitate each individual horse from injury.

There is much scope for further research to investigate the effects of the depth of the water during aqua-treadmill exercise on less symmetrical horses along with investigating the movement of the whole of the horse's back to further support the application of the aqua-treadmill as a tool for rehabilitation.

References:

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