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**THE EFFECT OF EARLY EXERCISE ON THE  
ARTICULAR CARTILAGE AND SUBCHONDRAL BONE  
OF THE DISTAL THIRD METACARPAL/METATARSAL  
BONES OF YOUNG THOROUGHBRED HORSES.**

**A thesis presented in partial fulfilment  
of the requirements for the degree of  
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## ABBREVIATIONS

<b>BMD</b>	Volumetric bone mineral density
<b>CDET</b>	Common digital extensor tendon
<b>CLSM</b>	Confocal laser scanning microscopy
<b>DDFT</b>	Deep digital flexor tendon
<b>DJD</b>	Degenerative joint disease
<b>DXA</b>	Dual x-ray absorptiometry
<b>ECM</b>	Extra-cellular matrix
<b>HA</b>	Hyaluronan
<b>Il-1</b>	Interleukin 1
<b>Mc3</b>	Third metacarpal bone
<b>MCP</b>	Metacarpophalangeal
<b>MMP</b>	Matrix metalloproteinases
<b>Mt3</b>	Third metatarsal bone
<b>MTP</b>	Metatarsophalangeal
<b>NO</b>	Nitric oxide
<b>OA</b>	Osteoarthritis
<b>P<sub>p</sub></b>	Proximal phalanx
<b>PG</b>	Proteoglycan
<b>PI</b>	Propidium iodide
<b>pQCT</b>	Peripheral quantitative computed tomography
<b>PSB</b>	Proximal sesamoid bones
<b>ROI</b>	Regions of interest
<b>RA</b>	Rheumatoid arthritis
<b>SDFT</b>	Superficial digital flexor tendon
<b>SCT</b>	Subchondral calcified tissues
<b>SCB</b>	Subchondral bone
<b>TNF</b>	Tumour necrosis factor

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## ABSTRACT

The effect of early moderate exercise on articular cartilage and subchondral bone were investigated by comparing two groups of age and sex matched, pasture reared, 18 month old ( $\pm$  one month) Thoroughbred horses. The treatment group (n=6, 3 colts, 3 fillies) were exercised five days per week from 10 days of age on a purpose-built grass racetrack. The control group were managed identically but did not participate in an exercise programme.

Articular cartilage samples were taken from all horses, from the palmar and dorsal regions of the left and right distal third metacarpal bones (Mc3) and the palmar region of the left third metatarsal bone (Mt3). The sites were selected from regions that sustain high (palmar region) and low (dorsal region) load during exercise. The fresh articular cartilage samples were incubated with fluorescent stains (calcein-AM and propidium iodide) and examined under confocal laser scanning microscopy to assess chondrocyte viability. The number of viable and dead chondrocytes at each site was determined based on the fluorescent staining characteristics. The subchondral epiphyseal bone mineral density adjacent to the articular cartilage sample sites was measured using computed tomography data from regions of interest which were 2mm proximal to the interface of calcified cartilage and subchondral bone.

There was a 14% greater percentage of viable chondrocytes in the exercised horses ( $p=0.001$ ), and a 34% greater percentage of viable chondrocytes at the control palmar regions compared to control dorsal regions ( $p=0.001$ ). One exercised horse and five control horses had subtle macroscopic features consistent with osteoarthritis (OA) in the metacarpo(tarso)-phalangeal joints. Variation in chondrocyte viability was less in palmar and dorsal sites from exercised animals, and palmar sites from control animals. An association between percentage of dead chondrocytes and sclerosis of the subchondral bone (SCB) could not be identified. Lower chondrocyte viability occurred independently of SCB sclerosis. The sequence of initiating events leading to reduced articular cartilage viability appeared to be unassociated with SCB sclerosis at the sites of distal Mc3/Mt3 under the moderate exercise regimen imposed.

The effect of early exercise on the articular cartilage and SCB of young Thoroughbred horses has been further elucidated. Early exercise appeared to have beneficial effect on the viability of the articular cartilage sampled in this group of horses. The abnormalities detected may have been the earliest stages of idiopathic OA, but the relative and temporal involvements of articular cartilage and SCB remain undefined.