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
Master of Veterinary Science
at Massey University, Palmerston North
New Zealand.

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2003

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ABBREVIATIONS

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

ACKNOWLEDGEMENTS

I am very grateful for the encouragement and assistance provided by friends, family and colleagues during the course of this thesis.

In particular, I am extremely fortunate to have had the benefit of working with my supervisors, Professor Elwyn Firth, Dr Chris Rogers and Dr Chris Kawcak. I am indebted to them for their generosity in providing, their time, guidance and advice, and for igniting and fuelling an interest in musculoskeletal research.

I am especially grateful to The New Zealand Equine Research Foundation for their generosity in providing financial assistance towards this project. I would like to thank The Global Equine Research Alliance (GERA) for allowing me to use tissues from their animals and to work with such world renowned researchers.

Special thanks must be extended to Liz Nickless and Al Rowland for their patience in guiding me through the wonderful world of confocal microscopy. Liz's expertise in image analysis was also appreciated as was Don Bailey's input. Mike Doube's ever present enthusiasm was also an important factor in this project. The original illustrations in Chapter 2 are mostly due to Mike's artistic abilities. I would like to thank Dr Peter Bush for his advice on viability staining of articular cartilage, and Mervyn Birtles, Guy Hessell and Marti Sherin for their expertise and advice with the histological slides and CT scanning respectively.

I would like to thank Trish Moffat, Donna Williamson, Andy Hunt, Vaughan Seed, Tony Mogg, and Martin Johnson for their support. Dr Mark Ethell was instrumental during the early phases of this study and his input has been a major influence during my initiation into research and veterinary surgery.

To my parents Bob and Muriel, thank you for your never-ending encouragement and support.

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 (± 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.