Intention of the study
To determine changes occurring during early life in the tissues of bones and joints of racehorses, to investigate if alterations in the tissues predisposing to injury might already be present before training, and to quantify how much tissues change with training and withdrawal from training.

Changing structure in the condylar fracture site. After showing changes in the exact site of condylar fracture initiation in horses before training, imaging of tissues from foals, weanlings, yearlings, two year olds after early training, and three year olds after racing showed that the very first evidence of abnormality in the cartilage and in the bone occurs before 5 months of age. Further CT examination of whole bones is being undertaken presently.

Microcomposition of bone and cartilage tissues. Vibrational spectroscopy on samples of bone has probed the relationship between the chemical microstructure and morphological properties of bone. This is to test how the mineral or collagen chemical composition of bone changes during growth, and if the condylar fracture site (see above) is different from that in other tissues. Principal component analysis has shown clear differences between horses and between ages, in spectroscopic parameters in the sagittal groove; complex mathematical analyses are being undertaken presently.

Strengthening bones of young horses before training begins. In horses that had received conditioning exercise from early in life, the bone shaft of the distal limb bones was bigger and stronger, and the increased bone strength was retained through the 2 and 3-year-old racing years, compared with horses in which extra exercise has not been imposed from an early age. The use of early exercise may reduce the onset of sore shins, and possibly other orthopaedic problems, in horses in training. The effect appears not to be confined only to the lower limb bones, since in a separate study, clear changes were also evident in the radius and tibia.

Enlarging the size of the joint in the young horse. Increasing joint size by imposition of exercise to make the organ stronger is said to be impossible (in contrast to the bone shaft), and has been shown in only one study (in people). Our data on joint enlargement showed that in 3-year-old racing Thoroughbreds (if they had had conditioning exercise as a foal from a very young age) the metacarpo-phalangeal joint was larger, and the bone density lower, than in horses that had not been exercised from an early age. These findings may have implications in the onset of impact-related disease, and if proven, may represent a further benefit of exercise from early in life.

Quantifying the response of the metaphysis. Most fractures involve the metaphysis, because the cortical shell there is thin, and bone turnover is higher than in the shaft. Perhaps the complex structure and dynamic behavior of the metaphysis could be induced to change (positively), reducing likelihood of fracture. A method to quantify the structure and changes in the bone fractions of the metaphysis has been developed. This “metaphyseal index” allows the amounts of the two types of bone to be determined, and shows quite wide variation between foals at 5 months of age and in 2-year-old horses.
References


Research Outputs
(Abstracts, Presentations, Papers, Industry Stories)


