Local bone volume fraction changes in racehorse proximal sesamoid bones are associated with training

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A subchondral osteopenic lesion is believed to precede racehorse proximal sesamoid bone (PSB) fractures. Our goal was to determine if osteopenia was focal and if lesion bone volume fraction (BVF) was related to exercise. Case racehorses (n=10) euthanised for unilateral biaxial PSB fracture supplied 10 fractured (FX) and 10 contralateral intact (CLI) medial PSBs. Control racehorses (n=10), euthanised for other causes, supplied 10 intact medial PSBs (CTRL). PSBs were imaged with micro-computed tomography. BVF was measured in two standardised Regions: a subchondral Region (SR), which overlapped the lesion (if present) or was at the average lesion site, and a Region bordering the SR (BR). Analysis of variance determined the effect of Group and Region on BVF. Robust linear regressions determined significant (P<0.05) relationships between BVF and exercise in each Region, using CLI and CTRL data (FX data excluded to prevent double sampling Case exercise). In the SR, BVF was lowest in FXs, intermediate in CLIs, and highest in CTRLs. BR BVF was similar among Groups. SR BVF was lower than BR BVF in FX and CLIs. Regional BVF was not different in CTRLs. In the SR, BVF decreased with events per year (r^2=0.11) and days since last layup (r^2=0.18). BR BVF was not associated with exercise. Study results indicate a focal osteopenic lesion develops bilaterally in the medial PSB before fracture in racehorses that suffer unilateral PSB fracture. Lesion osteopenia increased with exercise frequency, consistent with exercise induced local remodelling.

The effects of novel tailormade 3D-printed shoes on equine kinetic parameters

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Researchers recently introduced a tailormade three-dimensional (3D) printed shoe that fits the conformation of the individual horse. The aim of this study was to investigate the effects of this novel 3D-printed shoes on kinetic parameters compared to traditional steel shoes. The 3D-printed shoes, with frog- and heel-support, were designed based on a 3D scan of the hoof, printed in plastic materials, and then glued onto the hooves. Six rider-sound horses underwent a 3D-printed shoeing cycle and a steel shoeing cycle of seven weeks in a randomised order in which measurements were performed in week 1 (T0) and week 7 (T1). The horses were trotted with a pre-set speed range over a pressure- and force plate covered by a rubber mat. Kinetic parameters (n=10) were collected at a frequency of 250 Hz. Data were analysed using a linear mixed effect model with shoeing conditions and timepoints as fixed effects and horse and limbs as random effects. The results showed a significantly larger vertical impulse (VI) and peak vertical force (PVF) at T0 in the 3D-printed shoes (+179.0 N.s/kg, P<0.001, and +0.9 N/kg, P<0.001) compared to the steel shoes. The pressure was more evenly distributed between the hoof regions in the 3D-printed shoes at both timepoints compared to the steel shoes. The higher VI and PVF values in the 3D-printed shoes indicate that the horses exerted more force to the concerning limb and the pressure distribution in the 3D-printed shoes indicates a more balanced hoof loading.