Is there an association between foot conformation and foot-related lameness?

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There is anecdotal information that poor foot conformation or balance are related with an increased risk of foot-related lameness. The “ideal foot” should have a parallel hoof wall and heel, parallel horn tubules and growth rings and mediolateral symmetry of the coronary band. Foot conformation influences biomechanical function, the contact forces on the navicular bone, turning movements around the distal interphalangeal joint and leverage on the toe at breakover. There is lack of evidence based information concerning foot conformation and lameness, but in a study of sports horses, horses with asymmetrical front feet left the competition population earlier than those with symmetrical feet (Ducro et al. 2009a,b). Digital photography provides an accurate method of measurement of hoof conformation (White et al. 2008). The purposes of the study (Dyson et al. 2001a,b) were to document photographically the foot, shape and external characteristics of lame and non-lame horses. It also aimed to determine the relationships between the angles and shape of the hoof capsule and the distal phalanx to see whether angles of the distal phalanx could be predicted by assessment of the foot. The study also aimed to determine whether there was a relationship between the cause(s) of foot pain and foot morphology and/or angles of the distal phalanx.

Digital photographs of the front feet of 300 horses with foot-related lameness were reviewed. Digital photography was also performed on the feet of control, sound horses. All lame horses underwent a comprehensive clinical investigation to determine the cause(es) of lameness. Feet were excluded that had not been trimmed for more than 5 weeks, if there was a history or clinical evidence of laminitis, or if a pad was present that altered hoof angle. Angles and lengths were acquired from both photographs and radiographic images.

There was a higher frequency of occurrence of concavity of the coronary band in lame horses compared with sound horses. The horn tubules were non-parallel in 72% of non-lame feet and 80% of lame feet. There were no significant differences between the groups. The growth rings diverged towards the heel in 80% and 83% of non-lame and lame feet respectively. The growth rings generally followed the contour of the coronary band, but were also influenced by heel shape and angle. In the majority of horses the dorsal hoof wall angle was greater than the heel angle. There were no significant differences between the lame and the non-lame horses.

The coronary band angle was significantly larger in lame horses compared with non-lame horses. The hoof wall length to heel ratio and the dorsal to palmar coronary band heights were larger in lame feet compared with non-lame feet. The frequency of occurrence of a low collapsed heel (less than 5°) was not significantly different between lame and non-lame horses. In 22% of unilaterally lame horses, the lame foot was taller, and more narrow than the non-lame foot. In 10% the lame foot had a long toe and low, collapsed heel.

Horses with injuries of the podotrochlear apparatus had a larger coronary band angle and dorsal to palmar coronary band height ratio than non-lame horses. Horses with injuries of the
deep digital flexor tendon and podotrochlear apparatus had a larger coronary band angle, dorsal to palmar coronary band height ratio and hoof wall length to heel length ratio.

Variations in shape and angulation of the distal phalanx were largely due to differences in the orientation of the concave solar border of the distal phalanx to the horizontal. Variations in shape and angles of the distal phalanx were not accurately correlated with external characteristics of the hoof capsule. There were weak associations between injury groups and angles of the distal phalanx.

The study was limited to appraisal of the foot from the lateral aspect. There were no comparative medial images and no objective information concerning mediolateral balance was available, although subjective information had been recorded. The horses were drawn from a wide geographical area and therefore had been trimmed by a large number of farriers of variable expertise which obviously would influence hoof conformation. There are other potentially important factors for foot-related lameness including the pastern foot axis, alignment of the digit relative to the perpendicular bisector of the more proximal aspects of the limb and relative heights of the coronary band medially and laterally. These were assessed subjectively, but were not included in the statistical analysis. It was concluded that the relationships between the hoof capsule and the distal phalanx, podotrochlear apparatus and deep digital flexor tendon are complex. The causes of foot pain are likely to be multifactorial.

References and further reading


