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Original Research

Correlation Between the Conformation of the Distal Forelimb and Superficial Digital Flexor Tendon Lesions in Flat Racing Thoroughbreds

Maria Carlotta Fugazzola [a,*], Ilaria Lancioni [a], Maria Carolina Duran [b], Fernando Canonici [c], Lucio Petrizzi [a]

[a] Department of Clinical Veterinary Sciences, University of Teramo, Teramo, Italy
[b] Department of Clinical Veterinary Sciences, WCVM, University of Saskatchewan, Saskatoon, Canada
[c] Equine Clinic "Equine Practice srl", Campagnano di Roma (RM), Roma, Italy

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ABSTRACT

The aim of the study was to determine the correlation between front limb conformation and the development of superficial digital flexor tendon (SDFT) lesions in flat racing Thoroughbred horses. Ninety-three 4-year-old flat racing Thoroughbreds trained in the same training facility were included in the study; 66 horses were orthopedically sound, and 27 had a history of an SDFT injury. Four different radiographic images of the distal parts of both front limbs were taken from each horse. After testing the repeatability of 18 digitally measured parameters, these measurements were taken for all the animals. The possible effect of conformation on SDFT lesion development was assessed by analyzing the association between each measured variable and the sound and/or lesion status of the horses. Differences between the two groups for each parameter were analyzed using *t* statistics. Sound horses showed a greater proximal interphalangeal dorsal joint angle than horses with an SDFT lesion. A smaller distal width of the middle phalanx was also associated with fewer tendon lesions. However, none of the measured conformational parameters showed a strong association with the development of SDFT lesions. It appears that conformational traits of the distal parts of the forelimb of flat racing Thoroughbreds are not a major contributing factor to the development of SDFT injury if analyzed separately.

1. Introduction

In the racing industry and in the equine industry in general, conformational parameters have historically been considered an important indicator of potential soundness and performance when purchasing horses or selecting breeding stock. In particular, a frequently expressed belief in racing environments is that a long sloping pastern will predispose to superficial digital flexor tendon (SDFT) lesions.

Photography as a mean of conformational evaluation has been used to assess a possible correlation between conformational parameters, performance [1,2] and soundness [3,4]. In two major studies involving Thoroughbred yearlings, the significance of conformational influence was difficult to determine because there were strong sire-related influences [2,4]. A study on elite Swedish sport horses concluded that there were no significant differences in the prevalence of mild deviations from ideal conformation in horses performing at a high level compared with those performing at a lower level [1]. In contrast,

* Corresponding author at: Maria Carlotta Fugazzola, Piazza P. Thouar 31, 00135 Roma, Italy.
E-mail address: maria.fugazzola@gmail.com (M.C. Fugazzola).

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conformation does seem to have an influence on skeletal soundness [3]. In a study using a three-dimensional (3D) motion analysis system, this was confirmed by correlating certain conformational traits to a major incidence of specific musculoskeletal lesions [5]. However, weighed up against the importance of other factors influencing the incidence of musculoskeletal lesions such as training ground, trainer, and so forth, the role of a horse's conformation remains debatable. Radiographic images have previously been used to measure conformational parameters [6,7]. Assessing conformational parameters using this technique could provide more repeatable and accurate measurements of bone length and width than using photography because it does not depend on external landmarks.

Forelimb SDFT lesions are recognized as being one of the most common musculoskeletal injuries in racehorses, with a prevalence of 10%–30% [8–12] accounting for enormous loss in the racing industry [13]. Ideally, each factor that may predispose to such an injury should be evaluated independently to determine its individual contribution to the complex developmental process of racing injuries; however, this is difficult to achieve. Nevertheless, it was hypothesized that conformational parameters would differ between sound horses and the ones that developed SDFT lesions. The aim of the present study was therefore to determine if skeletal conformation of the lower forelimb of Thoroughbred flat racehorses could specifically be linked to the presence of SDFT lesions. In particular, it was hypothesized that dorsal joint angles of the metacarpophalangeal (MCP) and interphalangeal joints as seen from a lateral view would be different in the two groups of horses. It was also hypothesized that a longer proximal phalanx (PP) would be associated with a higher incidence of SDFT lesions. Radiography was chosen as a mean of evaluating conformational parameters because of its field applicability and because it enables precise digital measurement of bone lengths and angles.

2. Materials and Methods

2.1. Animals

The minimum number of animals (n) required per group was defined according to the variability of the previously measured MCP and proximal interphalangeal (PIP) joint angles in National Hunt racehorses (alpha, 0.05; beta, 0.2) [14]. A sample size of 27 animals per group was calculated to be sufficient to detect a difference of 5° (one standard deviation) on the measured joint angle, assuming a standard deviation of 4.7 (MCP joint angle mean, 150.3°; standard deviation, 4.7; and distal interphalangeal joint angle mean, 163.8°; standard deviation, 8.8 [14]), a power of 80%, and a significance level of 5%. Ninety-three 4-year-old Thoroughbred racehorses used for flat racing which had been trained on the same surface and in the same training facility in Capanelle (Rome) were selected on the basis of their medical history and a clinical examination. The horses were divided into two groups, the clinically sound subjects (group S) and horses with history or present condition of an SDFT lesion in at least one of their front limbs (group L). Horses categorized as clinically sound had been free of any pathology regarding the locomotion system in their medical history. Additionally, the horses were clinically examined by palpating the limbs to assess size, consistency, and shape of the digital flexor tendons. The horses were inspected at walk and trot in a straight line, and a flexion test was performed before the radiographs were taken, to confirm soundness. Because SDFT lesions can only be detected ultrasonographically once they become clinically evident [15,16], an ultrasonographic evaluation of the tendon was not considered necessary in the sound group. For group L, inclusion criterion was a history of front limb lameness because of a lesion of the SDFT, ultrasonographically diagnosed by a veterinarian since the onset of training. To assess possible asymmetries between the right and left forelimbs, the measurements obtained for each right front were compared with those obtained from the left front. Measurements for the right and left limbs were then pooled together, and differences between both groups were assessed. All horses were shod in open aluminum shoes by the same race track farriers in a standardized fashion.

2.2. Data Collection

Radiographs were taken with each horse standing on a flat, even, and hard surface and positioned so that all limbs were evenly loaded. Ipsilateral limbs were positioned parallel to each other, so the horse was standing squarely. While positioning, particular attention was paid to the vertical orientation of the metacarpus. A metallic sphere was fixed dorsally on the pastern before radiography to be used as a calibration marker. Four different radiographic projections were taken for each right and left front limb with the X-ray tube mounted on a stand trolley. Two lateromedial projections were performed at different levels of the limb each with a different fixed imaging plate focus distance. The more proximal projection focused on the MCP joint and was taken at a fixed focal distance of 90 cm. It served to measure the dorsal angle of the MCP joint and the length of the PP (Fig. 1). Repeated measurements tend to lead to a smaller standard error [17]. Therefore, repeatability of the MCP angle was assessed by repeating the proximal lateromedial projection three times, moving, and repositioning the horse between each projection to assess stance-related variations of the dorsal MCP angle. Three repetitions were considered sufficient; any more would have meant unnecessarily high exposure to X-rays. The second lateromedial projection was more distal with the focus on the PIP joint and a fixed focal distance of 80 cm and served to measure the dorsal angle of the PIP and the length of the middle phalanx (MP). The proximal dorsopalmar projection was performed focusing on the middle third of the third metacarpal bone (MC3) with focal distance of 110 cm. It served to measure the length and distal width of the MC3, the frontal MCP angle, and the width of the proximal and distal aspect of the PP. The distal dorsopalmar projection focused on the MP with focal distance of 80 cm and was used to measure the width of the distal aspect of the PP, the width of the proximal and distal