INDIVIDUAL EFFECT OF EQUINE DIGITAL MORPHOMETRIC PARAMETERS ON JOINT KINETICS: A SENSITIVITY ANALYSIS

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INTRODUCTION

Excessive biomechanical stresses are commonly believed to be important in the pathogenesis of various osteoarticular disorders [1]. In order to explain better the relation between equine digital morphometric parameters and biomechanical stresses, a sensitivity analysis has been performed to compare individual effect of each equine digital morphometric parameter on kinetics.

METHODS

One Warmblood horse was used (body mass 450 kg). An inverse dynamic analysis was executed, using equine digital morphometric parameters (segmental length (L), segmental angle (α) and moment arms of muscles (dm)) combined to published kinematic [2,3,4] and kinetic [5] data. The net joint moment (M(t)), the muscle force (MF(t)) and joint contact force components (CF(t)) were estimated for the fetlock joint (Figure 1) during the stance phase of the trot (4m/s).

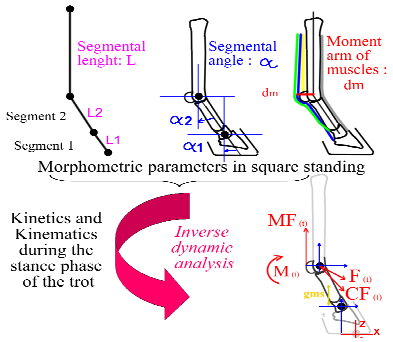

Figure 1: Estimation of the M(t), the MF(t) and CF(t) during a trot simulation, using digital morphometric parameters.

In order to test the sensitivity of the results to morphometric parameter changes, the net joint moments, the muscle force and joint contact force components were calculated repeatedly by letting the L, α, dm vary one by one with respect to their nominal values. For each parameter, the obtained results were compared between themselves and with the ones corresponding to the nominal values. The individual effect of each parameter, in the net joint moments, in the muscle forces and joint contact force components, was made clear. One-way analysis of variance with repeated measurements was used to test the effect of parameters (three levels), per unit body mass, in moments, in muscle forces, and in joint contact forces components. (α =0.05 ; statistical significance: $P<0.05$; post hoc testing of the means: the Bonferroni correction).

RESULTS AND DISCUSSION

For higher α or L or lower dm, per unit body mass the magnitudes of the net joint moments, muscle forces joint and contact force components were significantly ($P<0.05$) higher (Figure 2).

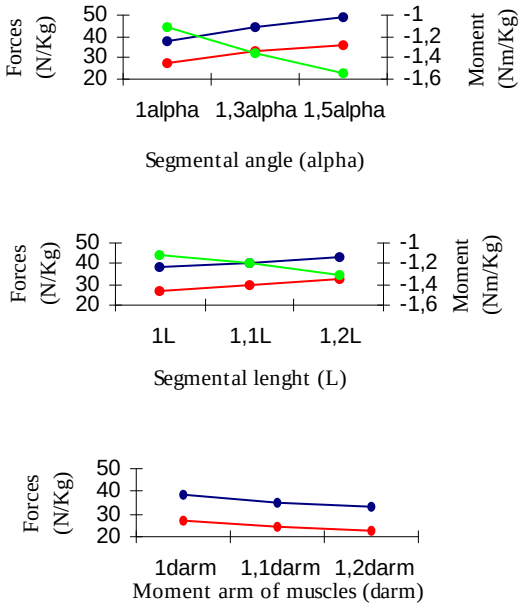

Figure 2 : Effect of segmental angle **(a)**, segmental length **(b)** and moment arm of muscles **(c)** on the net joint moment (green line), the muscle force (red line) and the joint contact force norme for the fetlock joint in the midstance of the trot (4m/s).

Indeed, when the horse is moving, just as its speed [6] or the surface on which it is moving has an influence, so morphometric data (such as α or L or dm) influence the net joint moments, the muscle forces and joint contact force components.

CONCLUSIONS

This sensitivity analysis showed that morphometric parameters of the equine digit influence joint kinetic components during motion. These results could be useful to understand better the relation between horse morphology, mechanical loading and osteoarticular disorders.

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