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Brief Communication

A CRITIQUE OF EQUINE JOINT KINEMATICS AND CO-ORDINATION

In a recent report *Fredricson et al.* (1) have laid the foundations for the experimental, cinematographic evaluation of equine joint kinematics. The importance of this work as an additional tool for elucidating the etiology of equine lameness cannot be overestimated. The volume of work presented and the mathematical sophistication evident, however, raises the danger that the results will be accepted uncritically by veterinarians and horsemen.

The purpose of the present discussion is to illustrate the dangers inherent in the interpretation of the results of high-speed cinematographic analysis. The example was chosen because the interpretation presented by *Fredricson et al.* appears to be at variance with earlier work of my own (2).

In their discussion of the "Biomechanical aspects of the carpus" (pp. 130—131), Fredricson et al. describe two "interesting" phases of carpal flexion: the first immediately after full protraction of the forelimb and the second immediately after heel contact. 1) "At the transition from protraction to retraction a most interesting observation was made. The forces acting on the carpus at this moment make the joint snap into full extension and then back to flexion again." 2) "Immediately following heel contact, the joint angle shows an interesting tendency to flex."

The reference points painted on the horses' legs to indicate carpal movement were placed at the lateral tuberosity of the distal end of the radius and the proximal end of the fourth metacarpal bone. In Fig. 1, then, movement of the distal spot relative to the proximal spot would provide the indicator, on the film, of movement of the carpus into flexion and extension.

It has been noted previously (2), on the basis of manipulation of osteoligamentous preparations that protraction of the limb is associated with a medial to lateral curving or rotatory movement of the carpus and most of its constituent bones. Such a rotatory movement, as shown in Fig. 2, would cause the distal spot, on the proximal end of the fourth metacarpal bone, to appear to move in the flexion direction when the film is analyzed in two

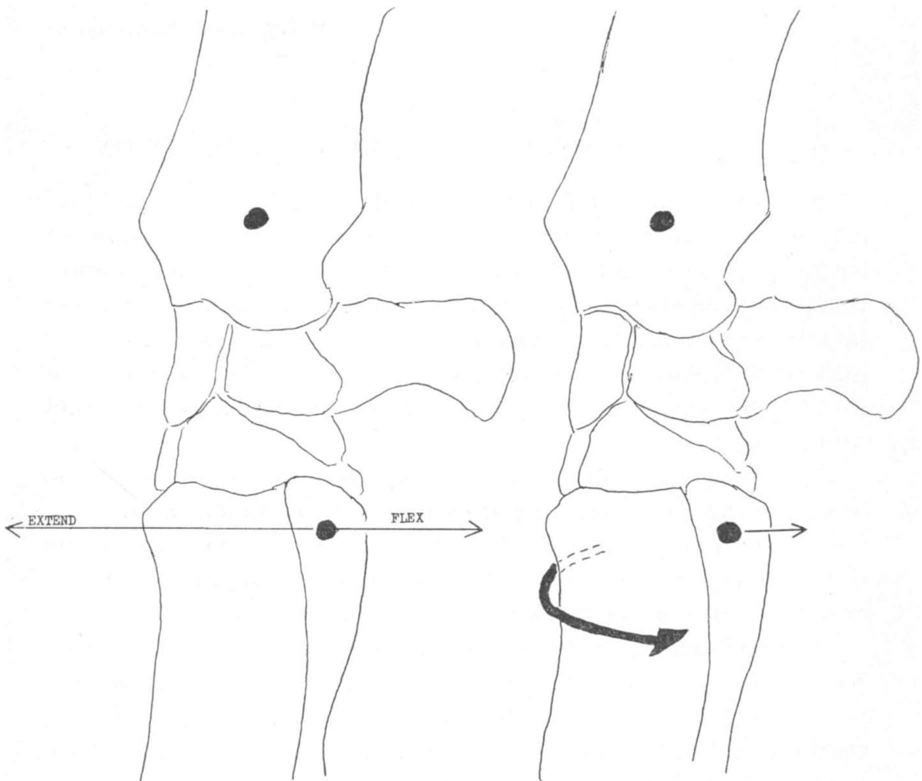

Fig. 1. Fig. 2.

F i g u r e 1. Movement of the marker on Mc 4 relative to marker on the radius is the measure of flexion and extension of the carpus.

F i g u r e 2. The medial to lateral rotatory movement, lateral view, showing that, in two dimensions, such rotatory movement will appear as flexion of the carpus, even though true flexion has not occurred.

dimensions. This rotatory movement around the vertical axis of the limb is in that third dimension which cannot be visualized by two-dimensional film recording.

Once again, it has been noted previously (2) that the carpus moves into extension during protraction and remains extended until impact (foot contact) and loading of the leg. Upon impact the carpus moves farther, into a more extended position known as the close-packed position. So-called overextension of the carpus, then, is, in fact, the close-packed extension of the carpus.

The first flexion noted by Fredricson et al., then, is simply the two-dimensional result of the rotatory movement of the limb, the distal spot moving in the flexion direction because the leg rotates as it moves into extension. The second apparent flexion, after heel contact, is the close-packing movement which occurs as the fetlock joint rotates the metacarpus farther laterally.

Fredricson et al. (pp. 45—64) showed that no serious sources of error were introduced by utilizing two-dimensional as opposed to three-dimensional analysis, for practical purposes. These results were derived from a study of the two- and three-dimensional aspects of hoof movement, all three co-ordinate points being fixed to that single rigid structure. It is clear that the confidence in two-dimensional analysis gained from a study of the hoof cannot be directly applied to the carpus.

It is not the intention of this brief discussion to, in any way, denigrate the work of Fredricson and his colleagues. Rather, it is an attempt to show that no one approach to the study of equine biomechanics can stand alone. While manipulation of osteoligamentous preparations may seem considerably less sophisticated than high speed cinematographic analysis, the results of such basic anatomical studies cannot be ignored. It is to be hoped that three-dimensional analyses will be undertaken in order to more fully clarify equine carpal function.

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REFERENCES

1. *Fredricson, I., S. Drevemo, K. Moen, R. Dandanell & B. Andersson:* Equine Joint Kinematics and Co-Ordination. Acta vet. scand. 1972, Suppl. 37, 1—133.
2. *Rooney, J. R.:* Biomechanics of Lameness in Horses. Williams and Wilkins, Baltimore 1969.

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