Sacroiliac Joint Motion and Pelvic Deformation in Horses

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Bony pelvic deformation should be considered a normal response to any sacroiliac joint movement. Authors’ addresses: Gail Holmes Equine Orthopaedic Research Center, Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523 (Haussler, McIlwraith); Department of Mechanical Engineering, Colorado State University, Fort Collins, CO 80523 (McGilvray, Ayturk, Puttlitz); and Animal Population Health Institute, Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523 (Hill); e-mail: kevin.haussler@colostate.edu. © 2008 AAEP.

1. Introduction

Sacroiliac joint injuries are a common cause of poor performance. Currently, the interaction between sacroiliac joint and pelvic mechanics is poorly understood. Osseous pelvic asymmetry has been hypothesized to be caused by sacroiliac ligament injury or rupture; however, tuber sacrale height asymmetries are common in most horses and are most likely caused by bony remodeling of the pelvis. A clearer understanding of the functional anatomy and mechanical behavior of the equine sacroiliac joint and pelvis is needed to better understand the pathophysiology of these performance-limiting injuries. The objective of this study was to measure pelvic deformation during three-dimensional sacroiliac joint movements. Our hypothesis was that patterns and amplitudes of displacement are equal for paired left and right pelvic landmarks during induced sacroiliac joint movements.

2. Methods

Sacropelvic specimens from 14 horses were used to assess sacroiliac joint motion and pelvic deformation during three-dimensional sacroiliac joint movements. The specimens were mounted vertically in a biaxial servohydraulic material testing system (MTS) with the sacrum anchored to a six-channel, multi-axis load cell attached to the upper portion of the MTS. Nine reflective triads were attached to local bony prominences. A pneumatic linear actuator was attached to a cable and a pulley system was used to mobilize the pelvis in flexion-extension and left and right lateral bending directions. Left-right axial rotation of the sacrum was induced by the upper MTS fixture while the ischium of the pelvis was firmly anchored to a lower platen. A static 90 N·m moment was applied for 10 s while three high-speed optical cameras recorded displacement of the markers during unloading and loading of the sacro-
pelvic specimens. Left-right comparisons of the amplitude and directions of marker displacement were done using paired t-tests (p ≤ 0.05).

3. Results
Flexion-extension of the sacroiliac joint caused vertical displacement of the ischial tuberosities and cranial-caudal displacement of the wings of the ilium relative to the sacrum. Lateral bending of the pelvis induced clockwise and counterclockwise rotational displacement of all pelvic landmarks within the horizontal plane. Axial rotation of the sacrum caused elevation of the wing of the ilium ipsilateral to the direction of sacral rotation and depression of the contralateral ilial wing. Significant paired left-right differences in pelvic displacement occurred during most sacroiliac joint movements.

4. Discussion
Similar amplitudes of pelvic displacement were measured during each paired motion of flexion-extension, left-right lateral bending, and left-right axial rotation. In all three loading conditions, the axis of rotation of the sacrum appeared to be located near the sacroiliac joints. The equine pelvis is not a rigid structure, and asymmetric pelvic deformation occurs during most sacroiliac joint movements. Results of this study may provide insights into the pathogenesis of unilateral tuber sacrale height asymmetries and bilateral tubera sacralia prominence (i.e., hunter’s bumps).

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