Physiologic Effects of Long-Term Immobilization of the Equine Distal Limb

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The objective of this study was to describe the effects of distal limb immobilization and remobilization in the equine metacarpophalangeal joint. Authors’ addresses: University of Pennsylvania, New Bolton Center, 382 West Street Road, Kennett Square, PA 19348 (Stewart); Orthopaedic Research Center, Colorado State University, 300 West Drake Road, Fort Collins, CO 80523 (Kawcak, McIlwraith); University of Florida, Department of Small Animal Clinical Sciences, Gainesville, FL 32610 (Werpy); e-mail: hstewartvet@gmail.com. *Corresponding and presenting author. © 2013 AAEP.

1. Introduction

One forelimb of eight horses was immobilized in a fiberglass cast for 8 weeks, followed by a 12-week standardized training program. The third metacarpal (MC3), proximal phalanx (PP), and proximal sesamoid bones (PSB) were examined by means of radiography, computed tomography, nuclear scintigraphy, and magnetic resonance imaging.

2. Materials and Methods

Serum and synovial fluid were collected for biomarker analyses. Lameness, decreased range of motion, joint capsule thickening, and joint effusion were observed in the immobilized metacarpophalangeal joint (MCP). Significant increases in bone sclerosis and lysis, osteophyte, enthesiophyte formation, and fragment formation were observed radiographically in the immobilized limb during the exercise period.

3. Results

Computed tomography examination revealed a significant time-by-cast interaction on bone density in MC3 and PSB. Magnetic resonance imaging revealed a significant increase in synovial proliferation, articular cartilage degeneration, osteophyte and enthesiophyte formation, and thickening within the soft tissues of the immobilized MCP, specifically the deep digital flexor tendon. Gross lesions in the MCP included wear lines, articular cartilage erosion, osteochondral fragmentation, and palmar arthrosis. Serum and synovial fluid biomarkers varied significantly with immobilization and exercise.

4. Discussion

Eight weeks of single-limb immobilization is sufficient to induce significant changes to bone mineral density, articular cartilage, and surrounding soft
tissues structures and alter the physiologic environment of the MCP in an immobilized equine forelimb. Twelve weeks of exercise is insufficient for recovery to pre-immobilization bone density and resulted in significant changes to the deep digital flexor tendon and periarticular soft tissue structures.