Dynamic Biplane X-Ray System/Intelligent Algorithms for Tracking 3-D Skeletal Movement

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Background

It is estimated that over 20 million Americans are plagued by the effects of osteoarthritis (OA) and that over 75% of the population will have radiographic evidence of OA by the age of 65, although only 50-60% of those will be symptomatic. As of today, there are no reliable and effective mechanisms available to detect OA in its early and potentially treatable stages.

Technology Description

This invention is composed of a system that facilitates examination of a subject using high-speed, three-dimensional (3D) motion at an extremely high resolution. The system enables examination of the subject on two different planes (bi-plane) which effects high speed 3D imaging of skeletal motion. These captured bi-plane images can then be used in combination with the information provided from computed tomography (CT) scans to reconstruct individual-specific joint motion.

Also under development is a software solution that can provide useful data in less time than the current manual user intervention. This solution eliminates the need for human input in this loop.

Advantages

• Provides accurate measurement (+/- 0.1 mm) assessment and direct 3D visualization of dynamic joint function
• Can overcome the limitation of conventional gait or motion analysis
• Software improves conventional methods by incorporating enhancements that significantly improve the speed, reliability and accuracy for bone motion tracking

Applications

• Assessment and diagnosis of musculoskeletal disorders, bone, ligament and joint injury, derangements of the spine and osteoarthritis.
• In-vivo assessment of multi-articular joints which include knees, hips, shoulders, spine, hips, ankles and feet.
• Pre-op screening to determine the need for surgery after injury.
• Predict clinical outcome following surgery

Stage of Development

• In vitro data, in vivo data, animal studies
• Prototype system constructed and fully functional

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PCT Patent Application Filed

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With the assistance of UPMC and the School of Medicine, the University of Pittsburgh has recruited Scott Tashman, PhD from the Henry Ford Hospital, Detroit, to build a new Orthopaedic Biodynamics Laboratory for computational evaluation of joint motion and function through the use of high speed cineradiography, which will allow in-vivo evaluations for knees, shoulders, spine, hips, and ankle and feet. Dr. Tashman brings an internationally recognized expertise in joint biomechanics using high-speed bi-planar radiography. Dr. Tashman’s work has been recognized by NIH research funding including a recent successful competitive renewal.

Research Interests

- Osteoarthritis
- Mechanics that guide and constrain the skeletal architecture of the human knee joint
- Three-dimensional motion of joints and inter-bone distances
- Biomechanics of abuse, misuse and trauma that results in cartilage damage and osteoarthritic joints.

Publications


