Patient-Specific Ct Scan-Based Finite Element Modeling (FEM) Of Bone

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BRIEF DESCRIPTION

This invention is a software for calculating the maximum force a bone can support. The offered method provides an accurate assessment of how changes in a bone due to special circumstances, such as osteoporosis or a long duration space flight, might increase patient's risk of fracture.

FULL DESCRIPTION

This software uses nonlinear finite element modeling (FEM) to rapidly create numerical, patient-specific structural models of the femur (thigh bone), hip, or other bones. The analysis of these models then quantifies patient-specific stress-strain fields within the bone, as well as the whole-bone strength under given loading conditions (the maximum force the bone can support or the force required to break the bone).The method's inputs are user-provided CT scans of the bone to be analyzed (with calibration phantoms), as well as answers to simple questions in DICOM format. The method uses finite element software, such as Abaqus, to accurately describe bone weakening and assess the risk of fracture due to disease (osteoporosis, cancerous metastases) or special circumstances (prolonged space travel). This method can also be used to monitor the progress of bone-affecting treatments (radiation therapies, drugs).

SUGGESTED USES

Assessing the risk of bone fracture due to disease (osteoporosis, cancer) or special circumstances (space travel), as well as evaluation of patients' responses to medications in pharmaceutical studies and clinically; bone remodeling predictions due to prostheses.

ADVANTAGES

-accuracy of the method

STATE OF DEVELOPMENT

The software is fully developed and is being used for research studies at UCSF. It might need to be modified for specific needs and/or integrated with customers' applications.

OTHER INFORMATION

Per inventor's comment, NASA is interested in licensing this software.

RELATED MATERIALS

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OTHER INFORMATION

KEYWORDS

Bone, Femur, Osteoporosis, Cancer, Space flight, Bone weakening, Risk of fracture, Bone modeling, Diagnostics

CATEGORIZED AS

- **Biotechnology**
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