# A Method For Calculating The Strength Of The Proximal Femur Under Loading From Impact Due To A Fall

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OTHER INFORMATION

CATEGORIZED AS

- **Imaging**
  - Medical
- **Medical**
  - Devices
  - Diagnostics
  - Disease: Cancer
  - Disease: Musculoskeletal Disorders
  - Imaging
  - Screening
  - Software
- **Sensors & Instrumentation**
  - Medical

## BRIEF DESCRIPTION

The invention (software) relates to methods for estimating the strength of the hip (the proximal femur) for assessing osteoporosis and the risk of hip fracture. It can also be used for other applications for which the strength of the hip is important. In this context, the strength of the proximal femur is defined as the maximum force that can be applied to the femoral head before the bone will break and no longer be able to support the applied force. It has been demonstrated previously that proximal femoral strength can best be estimated by combining quantitative CT scan imaging, which provides the bone geometry and density at each point in the bone, with a structural engineering technique called finite element (FE) analysis. In essence, this numerical technique subdivides a structure into many smaller parts (finite elements) which, together, explicitly represent the complex material heterogeneity and 3-D bone geometry as a mathematical model. Force or displacement is then mathematically applied to represent a specific loading condition, e.g. single-limb stance or a particular type of fall onto the greater trochanter. When the FE model is analyzed, stress and strain throughout the bone structure are computed. This information is used in conjunction with material failure criteria in various ways to estimate the strength of the proximal femur under the particular loading condition. Collectively, this technique is called, “subject-specific CT scan-based finite element modeling for calculation of proximal femoral strength."

This invention disclosure pertains to a specific improvement to techniques for patient-specific FE modeling for predicting the strength of the proximal femur for loading from a fall onto the greater trochanter

## RELATED CASES

2011-878-0

## SUGGESTED USES

This method can be used to assess the risk of hip fracture, either clinically or in research. In research, the technology could be implemented to evaluate the effect of new drug treatments to determine if they will reduce the risk of hip fracture. Underway are studies that will use this technology to determine if cancer therapies increase the risk of hip fracture. This could lead to monitoring cancer patients who are being treated to determine if they need preventive medication. Currently, patients are started on osteoporosis medications after about 1 year, if needed. This technology would allow assessment of effects on bone strength much sooner, so it would be potentially valuable for health care.

The software can be used with CT scanner and is likely to work with MRI as well.

## ADVANTAGES

Our technique indicates that the model more accurately represents the fracture process than previous methods.

Using this technique, the definition of whole bone strength for the proximal femur is objective, and is not based on arbitrary criteria.
These two factors make the models more likely to provide improved reliability when evaluating proximal femur strength and the consequence of low proximal femur strength, i.e. hip fracture.

## PATENT STATUS

| Country | Type | Number | Dated | Case |
|---|---|---|---|---|
| United States Of America | Issued Patent | 9,245,069 | 01/26/2016 | 2011-878 |

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