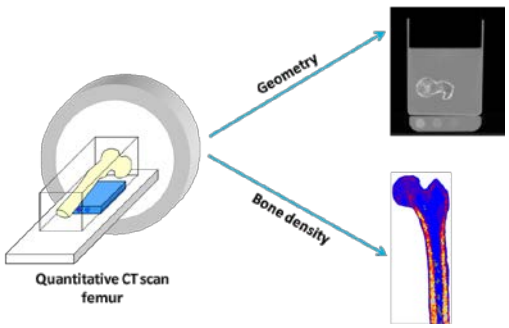
Creating a patient-specific method for fracture risk prediction in femurs with bone metastases – Principle Component Analysis

Patients with cancer and bone metastases have a decreased quality of life, due to pain. Additionally, bone metastases increase the risk of fracture. Treatment is base on the femoral fracture risk: patients with a low fracture risk are treated conservatively with radiotherapy, while patients with a high fracture risk will receive stabilizing surgery to prevent a fracture from occurring. However, in current clinical practice, it appears to be difficult to distinguish between high and low fracture risk patients, leading to high under and over treatment.

At the ORL, we are currently trying to improve the fracture risk predictions with the use of a finite element model. These models calculate bone strength, based on patient-specific anatomy and bone quality obtained from QCT images (Figure 1). Our finite element models have shown to be promising in experimental and clinical setting.

However, to create such FE model takes about 8 hours. This is too long to implement this tool in clinical practice. Therefore, we want to speed up the process. For this, one of the steps would be to determine the shape of the femur with the use of 'prinicple components'. We have a (small) database of segmented femurs, which can be used for this analysis.
The goal of this project is to perform such a principle component analysis on our database. In this way we can create an average femur, which can be used to morph scans of other patients on. Additionally, the principle components can be used for input to a fast statistical model, which also may estimates fracture risk.

Key words: Principle component analysis, fracture risk prediction, diagnostic tool



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