

# Relating compressive properties of human trabecular bone to morphometric parameters obtained by microCT

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## Aim:

The preliminary results of an ongoing research are presented, that aims to study the relationships between experimentally determined mechanical properties of trabecular bone of the human femoral head and the morphometric parameters obtained by microCT.

## Materials and Methods:

Cylindrical trabecular bone samples (length 26mm, diameter 10mm) were obtained from the femoral head of human patients. The specimens were examined by microCT (Skyscan 1072), for the determination of histomorphometric parameters, such as bone volume fraction (BV/TV), trabecular thickness (Tb.Th), trabecular separation (Tb.Sp), trabecular number (Tb.N). Then they were mechanically tested in compression along the main axis observable in the trabeculae. An extensometer was fixed to the central part of each specimen for the calculation of the elastic modulus (E) and the ultimate stress (Su). After the mechanical testing, the bone samples were microCT-imaged a second time. Then these samples were burnt for the determination of the ash density.

## Results and Discussion:

The ash density showed a strong linear relationship with bone volume fraction, supporting the use of BV/TV as a predictor of the bone mass. Significant relationships were found between E and BV/TV, and also between Su and BV/TV, in agreement with what reported in literature. Even if the other histomorphometric parameters (Tb.Th, Tb.N, Tb.Sp) were significantly correlated with the mechanical properties (E, Su), these correlations were lower. The pre- and post-failure-imaging of the bone samples can be helpful for a better understanding of the behavior of trabecular bone in compression. The described procedure showed to work reliably and is currently used for the investigation of trabecular bone samples collected from patients submitted to total hip arthroplasty.

## References:

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