

## AUTOMATIC IMAGE ANALYSIS OF TRABECULAR BONE STRUCTURE OF SELECTED STRESS REGIONS IN THE HEAD OF FEMUR

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The study investigated the structure of trabecular bone in the head of femur. Normal heads of femur were obtained at autopsy, osteoarthritic (OA) heads of femur and subcapital fractured heads of femur (#HOF) at surgery. Blocks of bone from the principal compressive (PC) and principal tensile (PT) regions of coronal slices were used to prepare thin sections for histoquantitation using a Quantimet image analyser.

A systemic sampling technique was used to quantify the percentage of mineralised bone, the trabecular surface density, the mean intercept length of the trabeculae and the marrow space. The mean intercept length is used as an index of trabecular thickness and marrow spacing.

The volume density of mineralised bone can be estimated directly from the Delesse principle. Errors in quantitation of sections arise because structural boundaries are not always equal to or greater than  $90^\circ$  to the plane of the section. For 10  $\mu\text{m}$  sections, the error in volume density due to section thickness is of the order of 5% or less.

The surface density of cancellous bone was quantified from the boundary projection per unit area of measured section. A measure of mean intercept length at an arbitrary angle is not strictly a measure of thickness in an anisotropic material. A measure of thickness in such a material is an average of mean intercept length for all angles  $0$  to  $180^\circ$ . Hence, assuming that the structure of trabecular bone is isotropic and has a prolate-type anisotropy, the error in trabecular thickness and marrow spacing due to anisotropy varies from -20% to +15% in the worst cases.

The amount of mineralised bone (MB) was greater in the PC region compared with the PT region, and showed a significant regression on age in both regions. The surface area (Sv) was higher in the PC region than in the PT region. In OA and # HOF cases having the same amount of MB as a normal, the OA group showed a significantly lower Sv. Sex differences were noted with some of the findings. The findings overall showed that changes in trabecular Sv, width and spacing depend more on bone mass than age. Compared to normals trabeculae are thicker but more widely spaced in OA and trabeculae are thinner but more widely spaced in # HOF.