

# Fractal Analysis of Bone Texture on Os Calcis Radiographs Compared with Trabecular Microarchitecture Analyzed by Histomorphometry

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Received: 2 July 1997 / Accepted: 8 January 1998

**Abstract:** Microarchitecture of trabecular bone is an important determinant of bone fragility; to date, its evaluation requires bone biopsy with histomorphometry analysis. Methods of noninvasive characterization of trabecular bone microarchitecture are in development and we have developed and validated a bone texture analysis applied to bone radiographs and based on fractal geometry. The aim of our study was to compare this fractal analysis of trabecular bone texture on radiographs to the trabecular microarchitecture analyzed by bone histomorphometry on os calcis biopsies. Thirty eight ossa calcis from 19 human cadavers were studied. Fractal analysis of the trabecular bone of os calcis radiographs was performed by the maximum likelihood estimator following the fractional brownian motion model. The ossa calcis were dissected, then transcortical biopsy cores focused on the fractal analysis region of interest were obtained. Structural and connectivity parameters were measured with both automatic and semiautomatic analyzers. We have found a significant relationship between the fractal Hmean parameter and structural histomorphometric indices; the best correlation was found with trabecular separation ( $r^4 -0.55$ ;  $P 4 0.0004$ ). Based on a stepwise regression analysis, trabecular spacing and trabeculae number together would explain 38% of the variance of the fractal parameter. Although the relationship with connectivity indices was poor, our fractal analysis of os calcis trabecular bone texture on radiographs seemed to partially reflect the trabecular bone microarchitecture.

**Key words:** Fractal analysis—Os calcis—Radiographs—Histomorphometry—Microarchitecture.