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QUANTITATIVE BONE HISTOLOGY AS A PREDICTOR OF SKELETAL HEALTH

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Abstract

Age and health status of an individual are key elements in a biological profile. When gross morphological assessments are insufficient, histological techniques may be applied; however, the histological estimation of age depends on a predictable progression of bone turnover, which can be disrupted by disease processes. An accurate histological age estimation depends, therefore, on the evaluation of skeletal health.

The effect of metabolic disorders on osteon population density (OPD) was assessed by meta-analysis of data from the literature. In total, nine studies yielded 425 ostensibly healthy individuals, which were compared to 52 individuals with clinically diagnosed systemic disorders and 17 individuals with abnormal histomorphology from the Office of the Chief Medical Examiner in New York City. The utility of OPD as a discriminating variable between healthy and diseased individuals was also assessed.

ANOVA results revealed no significant differences between the "normal" data sets, but significant differences were found between the healthy and the diseased data sets ($p < 0.001$). Linear regressions on the healthy and diseased groups demonstrated that OPD correlated well with age in healthy individuals, ($R^2 = 0.465$), but correlated significantly less well in diseased individuals, ($R^2 = 0.167$, $p = 0.001$). A discriminant function analysis was fairly sensitive (identifying over 80% of diseased cases), but not sufficiently specific when applied alone (correctly classifying 63% of healthy cases).

These results suggest that health status has a significant effect on OPD, and it follows that age estimations on diseased individuals is problematic. Furthermore, comparisons of age estimations between populations is subject to errors inherent in the age estimation equations as well as inaccuracies due to unknown health status, so it is suggested that only measurable biological variables be used to answer biological questions. As OPD is not a sufficient discriminant variable on its own, further exploration of histomorphometric variables and histomorphology is warranted for more accurate assessment of skeletal health.