DIFFERENCES IN CORTICAL MICRO-STRUCTURE BETWEEN WOMEN AND MEN WITH HYPO- OR HYPER-PARATHYROIDISM

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Introduction

We studied the effect of hypoparathyroidism (HPTH, parathyroid (PTH) level < 10pg/mL with hypocalcemia) and primary hyperparathyroidism (PHPT, PTH level > 55 pg/mL with hypercalcemia) on cortical structural factors that may influence fracture risk in patients, independently from bone mineral density.

Methods

Sections of bone biopsies from previous clinical investigations were used to analyze the cortical component with circularly polarized light microscopy (CPL) and Metamorph software (Molecular Devices), blindly with respect to disease [Parisien, 1997; Dempster, 1999; Rubin, 2010; Ascenzi, 2012]. CPL birefringence, bright or extinct, is indicative of specific orientation of collagen type I and of carbonated hydroxyapatite [Ascenzi, 2003]. Average birefringent brightness, percentage of bright area, width and area of bright regions, and percentage of each of single bright and single extinct lamellae were measured. Significant differences found with the *t*-test ($p<0.05$) are presented as mean±standard error.

Results

The percentage of single bright lamellae is lower in HPTH than PHPT for younger women (75.79±0.658 vs. 78.77±1.05, p=0.04). The percentage of bright area is lower in HPTH than PHPT for older women (19.47±3.92 vs. 41.05±5.46, p=0.01). The average brightness is lower in HPTH than PHPT for older women (0.38±.02 vs. 0.51±.02, p=0.003) and younger men (0.37±.03 vs. 0.52±.03, p=0.02).

Discussion

Bone tissue strength can differ up to 7-fold between birefringent extinct and birefringent bright regions with same degree of mineralization [Ascenzi, 2008]. This difference is due to the role of orientation in the bone tissue viewed as fiber reinforced composite of collagen and apatite. In this study, we showed that there were major differences in tissue level organization expressed in terms of component's birefringence. There were also differences to be observed based upon age. These differences were seen in younger women, older women and younger men. We show that the heterogeneity of collagen orientation is lower in HPTH than PHPT at the lamellar level in younger women, and at the 100µm scale for both older women and younger men, with a higher percentage of orientations aligned with the Haversian canals in HPTH older women. We are now focusing on the biological mechanism that establishes the orientation differences found.

Table

Age (#)	Younger women	Older women	Younger men	Older men
HPTH	44 ± 2 (7)	61 ± 4 (5)	36 ± 9 (3)	60 ± 3 (4)
PHPT	43 ± 2 (7)	61 ± 4 (5)	36 ± 1 (3)	60 ± 4 (4)

Table: We show age and number of patients.

References

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