2006 IOF+ANZBMS Combined Meeting

Combined Meeting of the
3rd IOF Asia-Pacific Regional Conference on Osteoporosis *and the*
16th Annual Meeting of the ANZ Bone & Mineral Society
~ 22-26 October 2006, Port Douglas, Australia ~
www.anzbms.org.au/asm/asm2006

Workshop Abstract
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Material and structural determinants of bone strength

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The most important clinical manifestation of osteoporosis is a fracture, which occurs when the loads applied to a bone exceed its strength. To develop effective diagnostic tools and fracture prevention strategies, it is critical to understand both the loads that lead to fracture as well as the determinants of bone strength itself. Bone mineral density (BMD) measurements are very strongly associated with fracture risk and thus are presently the gold standard for diagnosing osteoporosis and predicting the risk of fracture. Yet, evidence is mounting to support the concept that characteristics in addition to, and perhaps independent of BMD, may be important in the pathophysiology of osteoporosis and in the mechanisms that underlie the antifracture effects of osteoporosis therapies. These observations show that 1) many fractures occur among patients with BMD values that are not "osteoporotic" by WHO criteria and 2) changes in BMD following antiresorptive therapy explain a small proportion of the variance in fracture risk reduction. This presentation will interpret some of these clinical observations in the context of basic principles of bone biomechanics. The ability of a bone to resist fracture is governed by its morphology (ie, its size and shape and microarchitecture) and by the intrinsic properties of the bone material itself (i.e., the extent to which the bone matrix is mineralized, and the amount and type of collagen). Bone remodeling is the process that affects changes in these structural and material characteristics. Thus, age-related changes, diseases, or therapies that influence any of these components, or that influence bone remodeling, will ultimately influence fracture risk. New techniques to assess bone strength non-invasively will also be discussed.