



Workshop Abstract

W7

Bone microdamage and bone quality

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Low bone mass is not the only factor contributing to decreased bone strength. The accumulation of microdamage has been proposed as one factor that contributes to increased bone fragility with age and that may increase the risk for fracture in aging population. Microdamage is a manifestation of fatigue, which has been well recognized mode of material failure since long ago in the engineering field. In the fatigue process of materials, repetition of small load can cause microscopic physical damage, including cracks. The accumulation of microdamage increases fragility of the materials and finally leads to the material failure. However, in living skeleton, fractures never occur in usual situation although repetitive load is applied to the bone as well. This is because fatigue is self repaired by physiological bone remodeling. The microdamage burden in bone is a function both of damage that is produced, and the amount that is repaired through normal physiologic remodeling process. Either increased production of damage, or suppressed repair, can elevate the level of microdamage in bone.

The fact that increased microdamage accumulation causes reduction of bone mechanical properties makes a bad impression for bone metabolic mechanism. However, bone microdamage plays an important role in accelerating bone turnover by being detected and repaired. Therefore, production or accumulation of microdamage is indispensable for fundamental bone metabolism. The other important role of microdamage is to avoid sudden stress concentration and to elongate fatigue life of the bone. Thus, microdamage in bone is not an independent factor related to bone quality but closely related to bone remodeling or mechanical environment.

In this session, the following data regarding dog studies will be mainly presented.

- 1) Relationship between microdamage accumulation and bone remodeling in association with their localizations in transverse section of rib
- 2) Effects of suppressed bone remodeling by bisphosphonates on microdamage accumulation and mechanical properties of bone
- 3) Relationships between bone remodeling at ilium and bone remodeling or microdamage accumulation at distant skeletal sites