

Accepted Manuscript

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PII: S8756-3282(16)30279-4
DOI: doi: [10.1016/j.bone.2016.09.025](https://doi.org/10.1016/j.bone.2016.09.025)
Reference: BON 11143

To appear in: *Bone*

Received date: 28 August 2016
Revised date: 26 September 2016
Accepted date: 28 September 2016



Please cite this article as: Schwiedrzik J. Jakob, Mirzaali Mohammad J., Thaiwichai Suwanwadee, Best James P., Michler Johann, Zysset Philippe K., Wolfram Uwe, Response to the commentary on mechanical properties of cortical bone and their relationships with age, gender, composition and microindentation properties in the elderly, *Bone* (2016), doi: [10.1016/j.bone.2016.09.025](https://doi.org/10.1016/j.bone.2016.09.025)

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Response to the Commentary on Mechanical properties of cortical bone and their relationships with age, gender, composition and microindentation properties in the elderly

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In a recent commentary to our manuscript “Mechanical properties of cortical bone and their relationships with age, gender, composition and microindentation properties in the elderly” Thurner (2016) discusses several points that should be regarded in investigations of extra-cellular matrix properties with respect to age and gender. Thurner specifically mentions three points, two of which are of a very general nature and one which is specific to our study. These will be answered in the following sections.

1. Fracture location

The argument that testing should be conducted at the most important fracture location, i.e. the femoral neck, is well taken, but in practice mechanical testing of bone samples especially at the femoral neck is strongly limited by size for reproducible manufacturing, the low number of microstructural features contained in samples to make them representative, and artificial boundary conditions introduced by machining on the specimen surface. Beside the indentation work initiated in the late 90s (Zysset et al., 1999) only few biomechanical studies were realised on machined bone samples from the femoral neck, e.g. Malo et al. (2013) using ultrasound. While we agree that macroscopic mechanical testing of the femoral neck cortex would be most interesting, the variability of measured properties increases drastically when specimen shape is not reproducible and bone has been shown to exhibit a size effect. Therefore, the current gold standard at this length scale is to test specimens from locations with thicker cortex (Reilly and Burstein, 1975; McCalden et al., 1993).

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