

FRACTURE TOUGHNESS OF THE CANCELLOUS BONE OF *FNF* FEMORAL HEADS IN RELATION TO ITS MICROARCHITECTURE

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Introduction

This study considers the relationship between microarchitecture and mechanical properties for cancellous bone specimens collected from a cohort of patients who had suffered fractured necks of femur. OP is an acute skeletal condition with huge socioeconomic impact [1] and it is associated with changes in both bone quantity and quality [2], which affect greatly the strength and toughness of the tissue [3].

Methods

Over 88 samples from 37 femoral heads were dissected mechanically characterised for fracture toughness [3] and microCT scanned Nikon CT H225 (X-Tek Ltd) to derive the full gamut of microarchitectural parameters of the cancellous bone.

Results

The findings support a model where reduced bone mass results in a reduction in the number of trabeculae and trabeculae thickness and an increase in trabeculae spacing with concomitant changes in FT (Figure 1).

Conclusions

This study has crucially shown that TbTh, TbSp, SMI and TbN may provide a proxy or surrogate for BV/TV. Correlations were found between FT values and BV/TV, BS/TV, TbN, BS/BV and SMI. Overall, this study has highlighted that the fracture model based upon BMD could potentially be improved with inclusion of other microarchitecture parameters.

References

1. International Osteoporosis Foundation, <http://www.iofbonehealth.org/facts-statistics>
2. Hildebrand T, et al. J Bone Min Res, 14: 1167–74, 1999.
3. Cook RB & Zioupos P, J Biomechanics, 42: 2054–60, 2009.

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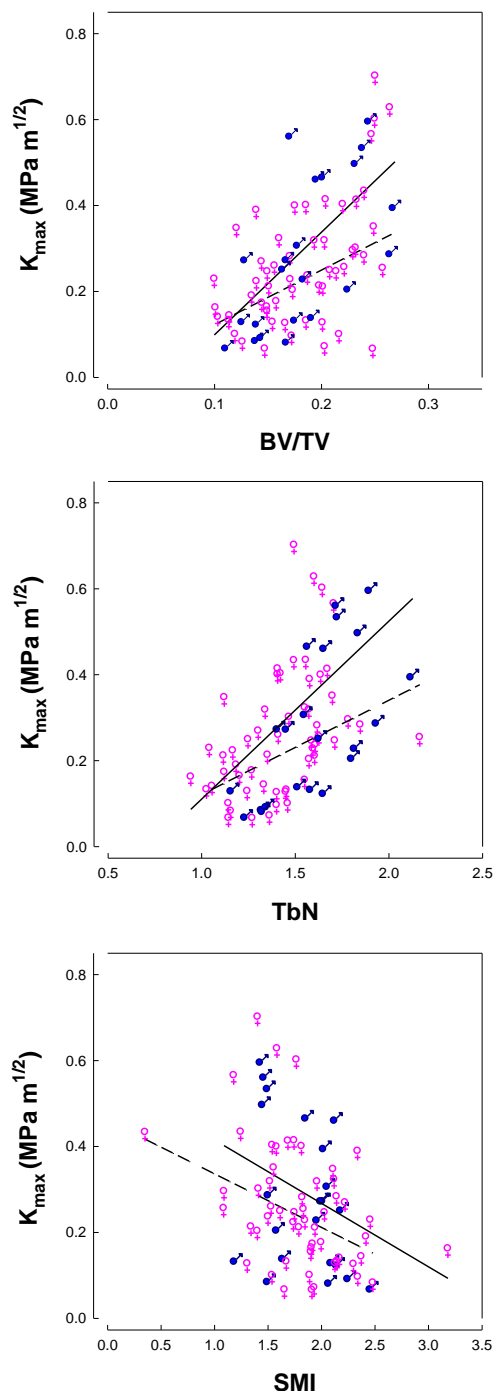


Figure 1: Critical stress intensity (K_C) as a function of various microarchitectural properties: (A) BV/TV; (B) TbN; (C) SMI. Male (♂) Female (♀).

