Kantonsspital St.Gallen

# Bone mineral density, mechanical properties and trabecular orientation of cancellous bone within humeral heads affected by advanced shoulder arthropathy

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The mechanical properties of cancellous bone in the humeral head are increasingly interesting due to increased popularity of stemless prosthetic fixation in the cancellous bone of the metaphysis. Age or pathology-related systemic osteoporosis, inactivity or pathology of the shoulder joint may influence primary bonding of implants that rely on good cancellous bone quality. We assessed the bone mineral density (BMD) and anisotropy using micro-CT (0.04mm voxel size) and correlated the results with indentation load/displacement response. Resected parts of humeral heads (from patients undergoing total shoulder replacement, n=18) were used as probes. The region of interest (ROI) was defined as 2mm medial from the resection plane, presuming that it mirrored the bone quality lateral to the resection plane. The indentation tests were performed with a large probe (diameter 10mm) in a single destructive loading procedure. The BMD and trabecular orientation were determined by micro-CT. Our results showed a correlation between the BMD and the slope of load/displacement curve. Furthermore, the trabeculae were predominantly oriented orthogonal to the joint surface. In conclusion, the predominant factor determining bone quality and mechanical resistance to pressure appears to be the BMD, while trabecular orientation could not be related to load/displacement response. CLINICAL SIGNIFICANCE: Bone quality predominately determines the mechanical properties of cancellous bone. This might be crucial when prosthetic implants need to be anchored in metaphyseal bone. Therefore, clinical decision-making processes should also include local BMD measurements. This article is protected by copyright. All rights reserved.

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