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Quantitative assessment of bone properties during defect healing in an animal defect model after augmentation with different bone graft materials using scanning acoustic microscopy

Mathias Schulz[a], Kay Raum[b], Joerg Brandt[b] and Kay Brehme[a]
[a]ZHBO Universitätsklinikum Halle, Dept. of Traumatology and Reconstructive Surgery, Ernst-Grube-Str. 40, 06120 Halle, Germany
[b]Martin Luther University of Halle-Wittenberg, Dept. of Orthopedics, Q-BAM Group, Magdeburger Str. 22, 06097 Halle, Germany

Introduction: The aim of this study was to evaluate the dynamic process of bone healing and bone remodelling in an animal defect model. A nanocrystalline hydroxyapatite in an aqueous suspension paste and mixed with either autogenous or allogenic bone was implanted. The investigation was performed using quantitative acoustic microscopy at a frequency of 50 MHz. **Materials and Methods:** 4-mm diameter defects were prepared on each femur at distal metaphysis in 60 white New Zealand rabbits. The animals were sacrificed after 2, 4, 6, 8 or 12 weeks. The influences on the acoustic impedance values only in the newly formed bone were analyzed by two-factor analysis of variance and post-hoc multiple comparison tests. Moreover, the kinetics of bone stiffening was evaluated by fitting the impedance data to an exponential growth model. **Results:** In all treatment groups the impedance increased with healing time. Significant differences between the treatment groups were observed 4, 6 and 8 weeks after treatment ($p<0.05$). The experimental results agreed with the exponential growth model with coefficients of correlation (R2) between 0.6 and 0.8. **Discussion:** Nanocrystalline hydroxyapatite paste in combination with autogenous bone was found to be superior to the other evaluated treatment strategies.