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Abstract: Fourier transform infrared spectroscopic imaging (FTIRI) was used to study bone healing with spatial analysis of various callus tissues in wild type mice. Femoral fractures were produced in 28 male C57BL mice by osteotomy. Animals were sacrificed at 1, 2, 4, and 8 weeks to obtain callus tissue at well-defined healing stages. Following microcomputerized tomography, bone samples were cut in consecutive sections for FTIRI and histology, allowing for spatial correlation of both imaging methods in different callus areas (early calcified cartilage, woven bone, areas of intramembranous and endochondral bone formation). Based on FTIRI, mineral/matrix ratio increased significantly during the first 4 weeks of fracture healing in all callus areas and correlated with bone mineral density measured by micro-CT. Carbonate/phosphate ratio was elevated in newly formed calcified tissue and at week 2 attained values comparable to cortical bone. Collagen maturity and mineral crystallinity increased during weeks 1-8 in most tissues while acid phosphate substitution decreased. Temporal and callus area dependent changes were detected throughout the healing period. These data assert the usefulness of FTIRI for evaluation of fracture healing in the mouse and its potential to evaluate pathologic fracture healing and the effects of
therapeutic interventions.