Abstract: In this review, we focus on findings obtained with biophysical techniques, Fourier transformed infrared (FTIR) spectroscopy and phosphorus-31 solid-state nuclear magnetic resonance ($^{31}$P solid-state NMR) spectroscopy, which may allow us to evaluate bone quality and to predict bone strength. FTIR measures the absorption energy that produces an increase in the vibrational or rotational energy of atoms or groups of atoms within the molecule. FTIR spectroscopy allows us to examine the relative amount of minerals and matrix content and the arrangement of apatite and organic matrix. FTIR spectroscopy should become an important tool, because the relative amount of minerals and the arrangement of apatite and organic matrix could be a measure for evaluating bone quality. $^{31}$P solid-state NMR spectroscopy is useful for evaluating the quality of bone and predicting bone strength by calculating the spine-lattice relaxation time ($T_1$) of bone. $^{31}$P solid-state NMR imaging can be used to measure quantitatively the mass of hydroxyapatite. The $T_1$ relaxation time of both bone and deficient hydroxyapatite was much longer than that of pure hydroxyapatite. $T_1$ relaxation time is one of the promising indices of bone quality. J. Med. Invest. 51: 133-138, August, 2004

Keywords: Fourier transform infrared spectroscopy, phosphorus-31 solid-state nuclear magnetic resonance spectroscopy, aging, bone quality, peripheral quantitative computed tomography
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Biophysical evaluation of bone quality
Mineral / matrix ratio

Time after surgery (weeks)

(A) Bone mineral density (mg/cm²)

(B) Mineral/matrix ratio

\[ p < 0.0001 \]
in vivo

et al

in vitro

et al