Purpose: Recently, several special MRI protocols have been developed for BMD measurements for deriving R2(=1/T2), R2*(=1/T2*) and R2'(=R2*-R2) applied in several cross sectional studies. But, due to high slew rate gradients with high amplitudes in small periods, such protocols can be used only in system with high slew rate (22 mT/m.s or greater). However, our main aim in this study was to develop optimized versions of standard GE and conventional SE protocols using in existing MRI systems for BMD measurements, as most systems do not support such newly high slew rate protocols.

Method and Materials: This study was performed by 1.5-T MRI system (Picker Vista-Q800, slew rate=13 mT/m.s.), SNR phantom (1.25 g/l CuSO4, T2=200 ms) for calibration, a body RF-Coil, cross sectional study with 12 normal, 12 osteopenia, 12 osteoporosis volunteers done with Lunar DXA system (DPX-MD). To determine R2* and R2, simple standard-GE and conventional phase-symmetrized-rapid-increased-flip-SE (PRISE) protocols with different TE/TR were applied. Then in coronal section of femoral-neck, relaxation rates were compared with BMD from DXA. The optimized conditions of the protocols for R2* measurement standard-GE protocol with TE=13.42/18/26.8 ms, TR=800 ms and ST=8 mm (CV(R2*)=2.96%) and for R2 measurement PRISE protocol with TE=36/54/63/72 ms, TR=800 ms and ST=8 mm (CV(R2)=3%), receiver bandwidth of 21.2 kHz for PRISE, 31.75 kHz for GE, Matrix=190x256, FOV=45 cm leading to good SNR.

Results: The overall Pearson's correlation coefficient of R2*, R2' and R2 vs. BMD were calculated as 0.62 (p<0.003), 0.62 (p<0.003) and 0.03 (p>0.9), respectively. Based on the R2* and R2' parameters, significant difference between normal and abnormal groups (osteopenia and osteoporosis) were found. However, there was no significant difference between osteopenia and osteoporosis groups using the relaxation parameters.

Conclusion: R2* and R2' showed a significant positive correlation with BMD. Therefore, in accordance with DXA values, the results showed standard-GE and conventional-SE (PRISE) could be proper protocols for BMD-measurements in femoral-neck even in low slew rates systems.