Background. The manual measurement of segmental range of motion (ROM) and anteroposterior translation in flexion-extension radiographs suffers from inaccuracies and repeatability issues that can reach magnitudes comparable to those of the quantities under investigation. We recently developed and validated a computer program able to automatically calculate these motion parameters and used it to investigate the association between overall disc degeneration and spinal motion. In this work we explored the potential correlations between motion parameters and specific lumbar degeneration phenotypes, namely disc degeneration, endplate defects, Modic changes and spondylolisthesis, as observed on MRI. Methods. A large database of 592 patients treated for lumbar spondylolisthesis was employed. All patients had undergone preoperative imaging including radiographs in standing, full flexion and extension, in addition to MRI examination. The presence of endplate defects, Modic changes, spondylolisthesis as well as the Pfirrmann grade of degeneration were annotated by an expert radiologist at all lumbar levels. All flexion-extension radiographs were processed with the automated tool to calculate the segmental motion parameters. Differences in spinal motion between degenerative phenotype grades were examined using Mann-Whitney test for binary variables and Kruskal-Wallis followed by Dunn's post-hoc tests for non-binary ones. Multiple linear regression was performed to identify significant predictors of motion parameters among spinal level, Pfirrmann grade, Modic changes, endplate defects and spondylolisthesis. Results. Segmental ROM (Figure) and anteroposterior translation generally decreased with progressive increases in disc degeneration grade, with significant differences between Pfirrmann grades 3 and 4 for both variables ($p<0.001$). ROMs were significantly smaller in patients with endplate defects, Modic changes and spondylolisthesis, whereas lower anteroposterior translation was seen only with Modic changes ($p<0.001$ in all cases). Multiple linear regression analysis confirmed these findings ($R^2 = 0.749$), with lumbar level ($p<0.001$), Pfirrmann grade ($p<0.001$), endplate defects ($p<0.001$), Modic changes ($p<0.001$) and spondylolisthesis ($p=0.035$) being significant predictors of the ROM while endplate defects and spondylolisthesis were not significant for anteroposterior translation ($R^2 = 0.668$). Conclusion. This study confirmed previous findings of an inverse relationship between the extent of disc degeneration and spinal segmental mobility and provided additional information about the relevance of specific degenerative phenotypes. Figure caption. Boxplots showing the association between ROM and (from left to right) Pfirrmann grade of degeneration, presence of endplate defects, Modic changes and spondylolisthesis.