The aim of this study was to analyze the precision of tibial cartilage morphometry, by using a fast, coronal water-excitation sequence with high spatial resolution, to compare the reproducibility of 3D thickness vs volume estimates, and to test the technique in patients with severe osteoarthritis. The tibiae of 8 healthy volunteers and 3 patients selected for total knee arthroplasty were imaged repeatedly with a water-excitation sequence (image time 6 h 19 min, resolution 1.2 x 0.31 x 0.31 mm\(^3\)), with the knee being repositioned between each replicate acquisition. After 3D reconstruction, the cartilage volume, the mean, and the maximal tibial cartilage thickness were determined by 3D Euclidean distance transformation. In the volunteers, the precision of the volume measurements was 2.3 % (CV%) in the medial and 2.6 % in the lateral tibia. The reproducibility of the mean cartilage thickness was similar (2.6 and 2.5 %, respectively), and that of the maximal thickness lower (6.5 and 4.4 %). The patients showed a considerable reduction in volume and thickness, the precision being comparable with that in the volunteers. We find that, using a new imaging protocol and computational algorithm, it is possible to determine tibial cartilage morphometry with high precision in healthy individuals as well as in patients with osteoarthritis.