

Appendix A. Analysis of tibiofemoral cartilage deformation in the PCL-reconstructed knee.

To evaluate the effect of the persistent changes in tibiofemoral kinematics after PCL reconstruction on the cartilage biomechanics, we analyzed the magnitude of peak cartilage deformation in the seven patients using the same methodology that has been described in detail in our study of tibiofemoral cartilage deformation in PCL deficiency.³ 3D meshed models of the tibial and femoral cartilage layers were created based on the 3 Tesla MR images. The relative positions of the cartilage layers on the femur and tibia were determined from the series of models used to reproduce knee motion. When cartilage contact occurred during knee flexion, the articular surface meshes of the tibia and femur overlapped. *Cartilage deformation* was defined for each vertex of the articular surface mesh as the amount of penetration divided by the sum of the tibial and femoral cartilage surface thicknesses.^{1,2} The cartilage thickness was calculated by finding the smallest Euclidian distance connecting a vertex of the articular surface to the cartilage-bone interface. A one-way repeated measures analysis of variance and Student-Newman-Keuls test was used to compare the magnitude of peak cartilage deformation of the intact contralateral, PCL-deficient, and PCL-reconstructed knees at every flexion angle. Differences were considered statistically significant when $p < 0.05$.

Analogous to our analysis of cartilage deformation in PCL deficiency, the magnitude of peak cartilage deformation was significantly increased in the medial compartment of the PCL-deficient knees, compared with that of the intact contralateral knees, between 75° and 120° of flexion. The maximum increase in cartilage deformation after PCL rupture occurred at 120° of flexion (0.18 ± 0.06 mm/mm in the intact knee compared with 0.25 ± 0.06 mm/mm in the PCL-deficient knee). In the PCL-reconstructed knees, the average peak cartilage deformation appeared to have decreased between 75° and 120° of flexion, compared with the PCL-deficient knees. However, the magnitude of peak cartilage deformation remained significantly increased in the medial compartment, compared with that of the intact contralateral knees, between 75° and 120° of flexion (**Figure 1A**). The maximum increase in cartilage deformation after PCL reconstruction occurred at 120° of flexion as well (0.24 ± 0.07 mm/mm).

In the lateral tibiofemoral compartment, we did not detect any significant differences in cartilage deformation between the intact and PCL-deficient knees (as was

described previously⁴¹), as well as the PCL-reconstructed knees throughout the range of flexion (**Figure 1B**).

The observed increase in magnitude of cartilage deformation in the medial compartment could provide an insight in the development of tibiofemoral joint cartilage degeneration in patients after PCL reconstruction.

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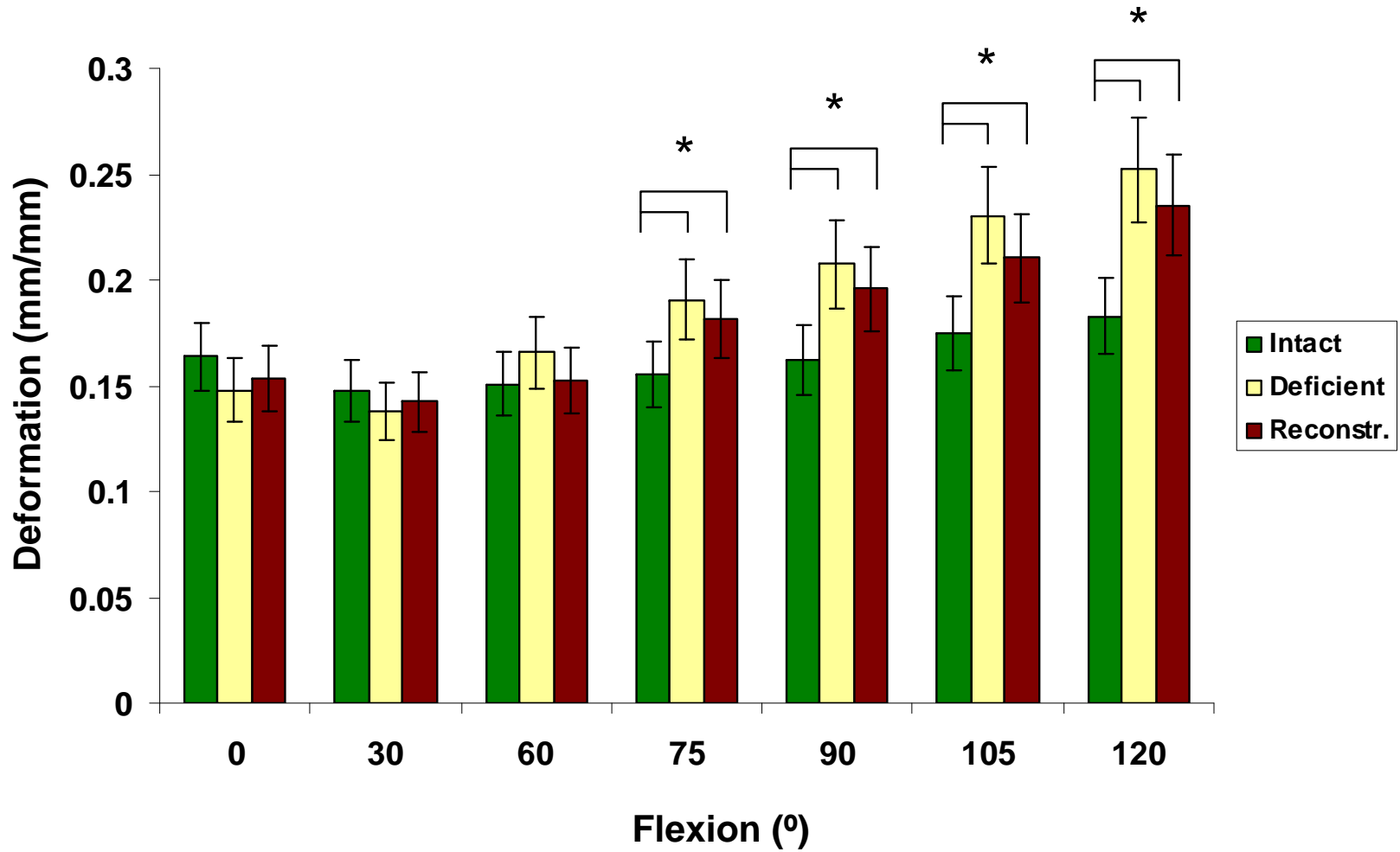
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Figure Legend

Magnitude of peak cartilage deformation for the intact, PCL-deficient, and PCL-reconstructed knees in the medial (A) and lateral (B) tibial compartment. * $P < 0.05$ as determined with one-way repeated measures analysis of variance.

A

Medial Tibial Plateau



B

Lateral Tibial Plateau

