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Student: Guggenberger Bernhard

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Do different walking strategies impact patella cartilage pressure in individuals with patellofemoral instability?

Bernhard Guggenberger; Brian Horsak; Andreas Habersack; Colin Smith; Hans Kainz; Martin Svehlik

Background: Patellofemoral instability (PFI) is a common orthopaedic condition in adolescence. Current studies used musculoskeletal simulations to investigate the influence of different morphological factors on patellofemoral joint loading. However, these studies were based on the gait pattern of one healthy individual and therefore, neglected the impact of different compensational walking strategies. Aim: This study aimed to investigate the influence of varying gait patterns on patella cartilage pressure (PCP) in individuals with PFI. Methods: We included 29 individuals (34 affected knees) with PFI. They were divided into a patellofemoral group 1 (PFG1, N = 12) and a patellofemoral group 2 (PFG2, N = 22), considering the sagittal knee moment in loading response phase according to Clark et al. (2016). The groups showed no differences in demographics, morphology and walking speed. Simulations were based on gait data and a musculoskeletal model with defined knee joint cartilage surfaces. PCPs were estimated using an elastic foundation model and the COMAK routine. For statistical analysis, alpha level was set to 0.05 and groups were compared using statistical parametric mapping. Results: Compared to PFG2, PFG1 showed increased knee extension, external rotation, hip extension and decreased dorsiflexion angles in stance phase. PFG1 showed lower peak and average cartilage pressure as well as cartilage contact area especially in the mid-stance phase compared to PFG2. Conclusion: Both groups walked with lower PCP compared to a typically developing group. The PFG1 walked with a more extended and externally rotated knee to achieve a higher reduction of the PCP. As simulations were based on a generic knee model, all differences of the simulations were related to the different walking strategies. Therefore, it can be concluded that it is essential to implement not only subject-specific geometry, but also individual gait pattern to investigate PCP in subjects with PFI.