Conference
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Title
A Case Study: Gait Efficiency and Biomechanics in a Bilateral Amputee with Retroverted K4 Feet

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Case Diagnosis
Bilateral transtibial amputee K4 ambulator with retroverted feet

Case Description
A 32-year-old male with bilateral transtibial amputation who competes as a K4 triathlete presented to our interdisciplinary limb loss clinic. He discovered that retroverted prosthetic alignment significantly improved his standing balance, gait, and function compared to the standard anteverted feet alignment. He now exclusively wears his prosthetics customized for retroverted wear, including during high K-level competition.

We conducted a gait analysis to better understand the underlying biomechanics (kinematics and kinetics) driving the retroverted preference. Patient walked on a force-sensitive 20-foot walkway in a motion capture lab under two conditions: 1) feet anteverted, and 2) feet retroverted. Five trials per condition were collected and averaged, with each trial lasting 7 seconds.

Discussion
The patient walked 1.16 m/s with a ~60 cm stride length bilaterally for both anteverted and retroverted K4 feet. With anteverted feet, there was increased knee flexion at the initial stance to 12 degrees and during mid-stance to 30 degrees, his knee kinetics were significantly reduced compared to normal, and he had a crouched posture with flexed head to counterbalance retropulsion. With retroverted feet, he demonstrated near full knee extension at the initial stance, with 10-12 degrees of flexion during the loading response and full extension during mid-stance, his knee kinetics were close to normal, and he had erect posture.

Conclusions
The patient's use of retroverted feet challenges traditional paradigms on prosthetic alignment. We conclude that his use of retroverted feet enables him to use less energy to accomplish higher level activity for a longer duration. Rehabilitation teams should consider a trial in retroverted aligned prosthetics for bilateral transtibial amputees.