

## **Gait Analysis in Children with Proximal Femoral Focal Deficiency**

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This study evaluates the relationship between classification, treatment, gait analysis, oxygen consumption, and overall function in proximal femoral focal deficiency (PFFD) prosthetic patients.

Gait analysis was performed on 19 patients with unilateral PFFD, including 6 with an equinus prosthesis (EQ), 6 with a rotationplasty (RP), and 7 with a Syme amputation (SA) and above-knee prosthesis. Medical records and radiographs were reviewed to establish the PFFD classification and all prior surgeries. Cadence parameters, kinematic and kinetic data (pelvic tilt, hip range of motion, hip power, abductor impulse), and oxygen consumption (VO<sub>2</sub> cost) were measured. The gait deviation index (GDI) was calculated from gait analysis data. Parents and/or patients completed the Pediatric Outcomes Data Collection Instrument (PODCI) at the time of gait analysis.

At a mean age of 11.8 years in the EQ group, RP 11.3 years, and SA 11.9 years ( $p > 0.965$ ), RP patients had undergone more mean surgeries (3.3) than SA (1.7,  $p = 0.015$ ) or EQ (0.7,  $p = 0.006$ ). Classification was not predictive of the chosen treatment. There was no difference in VO<sub>2</sub> cost between groups, all requiring greater energy expenditure than normal for age (EQ 156%, RP 144%, SA 154%,  $p > 0.824$ ). Likewise, there was no difference in abductor impulse, with all groups below normal ranges. EQ patients walked faster than RP (99% vs. 84% of normal age,  $p = 0.012$ ), and SA patients had improved kinematics compared to RP (GDI 69 vs. 61,  $p = 0.018$ ). Hip power at foot off was also greater in SA patients (0.75) than EQ (0.02,  $p = 0.013$ ) or RP (-0.1,  $p = 0.006$ ), a finding independent from walking speed. There were no differences in PODCI subscales of pain, sport/physical function, happiness, and global function. Transfer/basic mobility improves with age (Spearman 0.526,  $p = 0.030$ ), but no other correlations between classification, treatment, gait outcome variables, or PODCI scores reached statistical significance.

Rotationplasty patients required the most surgery with no benefit in walking speed, gait kinematics, power, oxygen consumption, or patient reported outcomes. Patients with Syme amputation and prosthetic knees often function well with improved power and kinematics compared to rotationplasty and require fewer surgeries. Patients with an equinus prosthesis do not have a conventional gait with a lower GDI score, but they walk fastest and have the fewest surgeries.

While treatment options in PFFD are often limited by patient anatomy, rotationplasty provides no functional improvement or patient reported benefit over other prosthetic treatment options. These findings contradict prior reports of rotationplasty for PFFD.