Abstract CPUP 2023

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Title
Does hip flexion contracture influence the result of orthopedic surgery in ambulatory children with bilateral cerebral palsy?

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Background and objectives
In children with cerebral palsy (CP) contractures often develops over time and gait deteriorates. The results of surgical management of ankle plantarflexion and knee flexion contractures have been extensively reported. Less attention has been directed towards hip flexion contracture, and its impact on functional outcomes.
The aim was to determine the influence of hip flexion contracture on improvement in gait after soft tissue and/or bony surgery in children with bilateral CP.

Material/Methods
132 children with bilateral CP, Gross Motor Functional Classification Scale (GMFCS) level I-III, and flexed knee gait pattern underwent orthopedic surgery. Pre-operative three-dimensional gait analysis was performed before surgery, and between 0.8 -2.6 years post-operative. Two groups were formed, matched by surgical procedures, with Group 1 having less than 10° hip flexion contracture and Group 2 with 10° or more.
Pre-and postoperative Gait Deviation Index (GDI) describing gait pattern was the primary outcome. In addition, pelvis and hip sagittal plane kinematics, gait velocity, step length, Gross Motor Function Measure D (GMFM-D) and use of assistive devices was collected.

Results
There were 31 children in each group, age 3.6-18.6 years in Group 1 and 4.8-18.4 years in Group 2. There were higher GMFCS levels in Group 2, and the use of assistive devices were also higher. Group 1 and Group 2 had a mean hip flexion contracture of -0.2° (SD 4.4°, range: -10 to 8°) and 14.8° (SD 8.2°, range: 10 to 50°), respectively.
GDI significantly improved in Group 1 70.1 (17.8) to 78.6 (15.5); $p<0.001$ and in Group 2 64.8 (14.4) to 70.6 (17.2); $p=0.042$. Gait velocity significantly improved in Group 2 60.5 (28.5) cm/s to 69.3 (30.6); $p= 0.041$ but not in Group 1 84.2 (26.6) to 86.1 (23.5) cm/s; $p=0.96$. Pelvis and hip kinematics did not change, except for an increase of mean anterior pelvic tilt in midstance for Group 2.

Conclusions/Significance
In ambulatory children with bilateral CP, the severity of pre-operative hip flexion contracture, in matched surgical groups, does not influence the improvement in gait pattern after orthopedic surgery. Surgical procedures included hamstring, calf, and adductor lengthening, rectus femoris transfer, tibial and femur osteotomies, foot reconstructive osteotomies/fusions. Improvement of gait velocity was noted only in the more severely involved group with hip flexion contracture of 10 degrees or more, concomitant with an increase of pelvic tilt.