The outcomes and the factors influencing the outcomes of rectus femoris transfer in cerebral palsy patients with stiff knee gait

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OBJECTIVES

- Although several studies have reported on the outcomes of rectus femoris transfer (RFT), few have investigated the multiple factors that could affect the results.
- We evaluated the outcomes of RFT and analyzed factors that influence improvement and annual change in knee motion after surgery in patients with cerebral palsy (CP).

METHODS

- We reviewed ambulatory patients with CP who were followed up after they had undergone RFT as part of a single-event multilevel surgery (SEMLS) and who had undergone preoperative and postoperative three-dimensional (3D) gait analysis between January 1995 and December 2012.
- Relevant kinematic values, including peak knee flexion, knee range of motion, and timing of peak knee flexion in the swing phase and gait deviation index (GDI) score, were the outcome measures.
- Improvements in rate of angle and GDI score were adjusted by multiple factors such as sex, Gross Motor Function Classification System (GMFCS) level, anatomic type of CP, and concomitant surgeries as the fixed effects, and follow-up duration, laterality, and each subject as the random effects, all of which was performed using a linear mixed model.

RESULTS

A total of 290 patients (487 limbs) and 612 3D gait analysis (2-4 per patient) results were finally included in this study.

- At 2 years after RFT, estimated mean peak knee flexion (1.2°, p=0.005), estimated mean knee range of motion (10.7°, p<0.001), and estimated mean GDI score (7.3, p<0.001) increased significantly.
- Peak knee flexion in the swing phase occurred 5.4% earlier after surgery compared with that at baseline (p<0.001) (Table 1).
- In serial postoperative gait analyses, peak knee flexion in the swing phase occurred 0.8% earlier per year in patients with GMFCS level I or II (p=0.021) (Fig 1).

CONCLUSIONS

- RFT as part of a SEMLS was effective in treating stiff knee gait.
- Peak knee flexion, knee range of motion, and timing of peak knee flexion in the swing phase and GDI score improved after RFT.
- During follow-up, patients with GMFCS level I or II showed better prognosis than those with GMFCS level III with regard to timing of peak knee flexion in the swing phase.
- Based on the results of our study, physicians can predict and inform patients and parents of the improvement in knee function after RFT in cases of CP with stiff knee gait.

Table 1. Changes in the estimated value of three-dimensional gait analysis at 2 years after rectus femoris transfer

<table>
<thead>
<tr>
<th></th>
<th>Peak knee flexion in the swing phase (°)</th>
<th>Knee range of motion in the swing phase (°)</th>
<th>Timing of peak knee flexion in the swing phase (%)</th>
<th>GDI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre</td>
<td>post</td>
<td>p-value</td>
<td>pre</td>
</tr>
<tr>
<td>Total</td>
<td>55.8</td>
<td>57.0</td>
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<td>GMFCS level I &amp; II</td>
<td>56.3</td>
<td>57.6</td>
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<tr>
<td>GMFCS level III</td>
<td>59.7</td>
<td>60.5</td>
<td>0.692</td>
<td>17.8</td>
</tr>
</tbody>
</table>

*After adjusting for sex, laterality, anatomic type of cerebral palsy, and concomitant surgeries. GDI; gait deviation index, GMFCS; Gross Motor Function Classification System

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