Effect of Hallux Valgus Surgery on Balance and Gait in Middle Aged and Older Adults: A 12 Month Longitudinal Assessment

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Abstract

Background: Hallux valgus deformity is associated with poorer balance and coordination, and has been implicated as a risk factor for falls in older adults. However, it is unknown what effect corrective surgery has on balance and gait in older adults.

Methods: In this prospective study, we followed middle to older aged adults who underwent hallux valgus surgery at our institute longitudinally for 12 months. Thirteen consecutive patients were assessed for gait and balance using non-invasive body worn sensor technology preoperatively and again at 12 months postoperatively, using standardized validated Scientific procedures.

Results: While subjects challenged their operative foot, standing in full tandem, center of mass (COM) sway was reduced (improved) by 59% postoperatively at the 12 month follow-up (p < 0.001, t-test). Gait variability, on the other hand, increased on average by 55% (p = 0.028, t-test) and medial-lateral sway while walking increased by 43% (p = 0.08, t-test) postoperatively.

Conclusion: Hallux valgus surgery appeared to improve balance in our patients, particularly when relying on the operative foot in stance. Patients also seemed to walk with greater variability in stride velocity and with greater medial-lateral sway postoperatively, which suggests perhaps greater confidence after bunion surgery.

Keywords: Hallux valgus, surgery, balance, gait, older adult

Results

<p>| Table 1 Mean Characteristics of Patient Population (n=13) |</p>
<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Height (cm)</th>
<th>Right Big (cm)</th>
<th>Left Big (cm)</th>
<th>Weight (Kg)</th>
<th>MI Score</th>
<th>Viscoelastic foot surgery score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>54.3</td>
<td>165.3</td>
<td>74.3</td>
<td>27.2</td>
<td>68.2</td>
<td>10</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>17.7</td>
<td>8.96</td>
<td>15.3</td>
<td>4.1</td>
<td>29.8</td>
<td></td>
</tr>
</tbody>
</table>

Age surged from 47 years to 70 years, while height ranged from 154 cm to 186 cm, weight surged from 64 kg to 77 kg, and BMI spanned from 18 to 40 kg/m².

Figure 1: Progression of Hallux Valgus Deforimty

Figure 2: Foot patterns of habitual wearing

Multiple gait parameters were evaluated for differences pre- and postoperatively at 12 months. The gait results were obtained through shod assessments for all patients and failed to reveal any changes in most gait parameters: stride velocity, stride length and double support time, etc. Gait variability, however, increased significantly (p = 0.028, t-test), on average by 55%, and medial-lateral sway while walking increased (p = 0.08, t-test) by 43%, postoperatively.

Discussion

Balance:

- While in double support, the modest increase in sway seen at follow-up (especially during eyes closed test condition) with increased RCI (less ankle hpr condition) might be due to potentially greater mobility within the first metatarsophalangeal joint in anterior-posterior (AP) direction after successful hallux valgus surgery. Moreover, during double support, relatively low coordination of ankle and hip was required in the medial-lateral (ML) direction, which might be due to the correction being performed in the AP direction.

- During full tandem test which challenges ML coordination within the operative foot (Figure 8), patients observed less center of mass sway area postoperatively, while also achieving lower RCI values as less correction was required in this direction.

- Notable decrease in center of mass sway area and lower RCI values may be due to reduced pain and more linear alignment of the first ray after surgery allowing the patient to distribute weight evenly on the medial aspect of their foot.

Gait:

- The significant changes in gait variability suggest that a successful hallux valgus surgery helped the patient change their walking pattern during initiation, steady state, and termination, suggesting to the authors more confidence while walking.

Conclusion

- Participants exhibited better postural control in medial-lateral direction when their operative foot was challenged suggesting improved postural control after successful bunion surgery.

- Participants also displayed greater variability in stride velocity and greater medial-lateral sway while walking postoperatively which may suggest that patients walked with greater confidence after surgery.

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References


