Comparison of Plantar Pressures Between Controls and Flatfoot Patients Using Supine, Standing and Walking Measurements

**Foot & Ankle Category:** Other

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**Introduction**
Intraoperative plantar pressure systems have the potential to guide surgical decision making, particularly in conditions such as adult acquired flatfoot deformity (AAFD). Such systems have been shown to improve patient outcomes. However, criteria upon which decisions are made and definitions of normal pressure distributions are lacking. We have previously designed a jig to assess supine plantar pressures and have proven its accuracy and reliability. The purpose of this study was to compare plantar pressures between flatfoot patients and normal controls to see if the system could detect differences and to compare supine measurements to walking and standing which ultimately determine clinical outcome.

**Methods**
Ten patients with flexible AAFD (stage II) scheduled to undergo surgical reconstruction (mean age 52.2 ± 10.0 years) were compared to ten patients (twenty feet) without any foot or ankle pathology (mean age 27.2 ± 5.7 years). Radiographic parameters were assessed to confirm differences between the groups. Supine plantar pressures were then assessed supine using the previously designed jig and a custom, Pliance sensor array (Novel, Munich, Germany) and then standing and walking with the EMED-XT sensor array (Novel). Contact area, maximum force (MF), and peak pressure (PP) were compared at 12 difference anatomical regions. Radiographic and plantar pressures were compared between the two groups for supine, standing, and walking test conditions with a Wilcoxon rank sum test. Differences between test conditions were evaluated with two way mixed ANOVA along with post hoc t-tests.

**Results**
Radiographic analysis demonstrated significant differences between the flatfoot and control for both the lateral first talo-metatarsal angle (p < 0.001), AP talonavicular coverage angle (p = 0.005), AP first talo-metatarsal angle (p = 0.004), and hindfoot moment arm (p = 0.001). No differences were detected for contact area between the groups. The flatfoot patients had significantly increased MF and PP for the medial midfoot and medial forefoot parameters for walking. During stance, no significant differences were found for any of the parameters. With the supine apparatus, only increased medial and lateral hindfoot MF and PP were found in the flatfoot group (Table 1). Significant differences were found for parameters at all anatomical regions between the supine, standing, and walking test conditions (p < 0.001).
Conclusion
The differences between test conditions indicate the differing nature of these musculoskeletal events and may limit inferences that can be drawn from intraoperative pressure assessment. The inability of the supine plantar pressure system in this study to detect differences between flatfoot and control patients suggests that it would not be helpful to guide intraoperative surgical decision making. However, given that differences were found for walking, but not standing (50% bodyweight) also questions the ability other systems to quantitatively guide intraoperative correction because applying such loads are both impractical and potentially damaging to the foot during surgery. Strict criteria for intraoperative decisions, which are currently lacking, must be developed.