

Plantar Pressures in a Typically Developing Pediatric Population: A Comparison of Mid-Gait and Two-Step Methods

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Introduction: Plantar pressure assessment is used to evaluate individuals with various pathological conditions. These data can assist with intervention decisions and later follow up. Pressure data allows an objective interpretation of the loading pattern on the foot in relation to the support surface and posture.¹ Methods of collecting this data include, the mid-gait method, and two-step methods. With the mid-gait method data is collected after the subject has ambulated for a distance of approximately 4-5 steps. With the two-step method, pressure data is collected from the subject's 2nd step.² It has been demonstrated in adults that data obtained through the two-step method closely approximates data collected through the mid-gait method.³ The relationship between these methods has not been established in children. The purpose of this study was to evaluate the correlation between the two-step method and mid-gait methods of plantar pressure assessment in typically developing children.

Statement of Clinical Significance: The mid-gait method most closely approximates a normal gait pattern, however, pathology may prevent the relatively prolonged walking time required to capture plantar pressure data via this method.⁴ Young children, particularly those with neurological diagnoses may have difficulty cooperating over the time it may take to collect the data using the mid-gait method due to issues such as limited attention span, cognitive deficits and fatigue. Understanding how closely the 2-step method of data collection represents the mid-gait method in children can help clinicians choose the most optimum method of plantar pressure data collection, especially when prolonged gait collection time may cause pathological forces in a child's lower extremity.

Methodology: Five subjects (mean age = 9.5 years) with typical development ambulated at a self-selected pace, across an Emed™ SF floor mounted pressure sensor platform (40x24 cm) (Novel electronics, St. Paul, Minnesota, USA). Stance duration was monitored from trial to trial to ensure they were within 40ms of one another. A minimum of 3 trials were collected from the feet bilaterally for the mid-gait and two-step methods. The average of these trials was obtained for the right foot and the left foot. Total contact area, maximum force, peak pressure, contact time, and force-time integral were assessed for the total foot and 5 distinct foot regions (Figure1). T-tests were used to assess differences between the mid-gait and two-step methods and between right and left

Figure 1. Foot pressure diagram demonstrating the five regions (M01, M02, M03, M04, M05) of the foot that were assessed.



sides.

Results: Alpha levels were adjusted to $P=0.01$ for multiple comparisons. There were no significant differences between the mid-gait and two-step methods for the entire foot and for any of the regions. A significant difference was found between right and left sides for total foot contact area in the mid-gait method ($P=0.003$). This may be related to the larger average forefoot widths measured on the right side. No significant differences were found between right and left sides for any of the other variables for each mask.

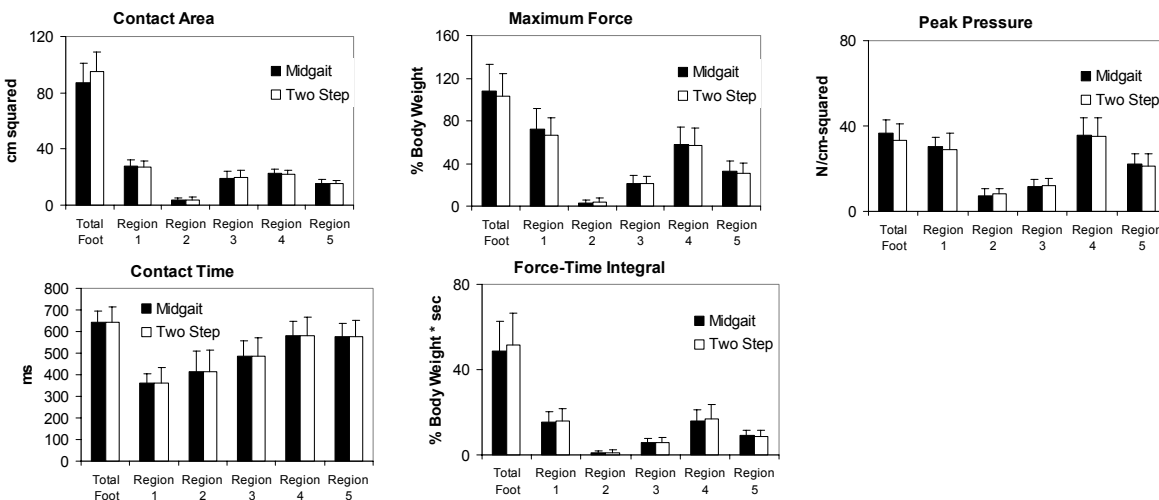


Figure 2. Means and standard deviation bars for total contact area, maximum force, peak pressure, contact time, and force-time integral for the total foot and for each of the five sub-regions (masks) averaged across the right and left side. Significant differences were not found between the mid-gait method and the two-step method.

Discussion: The child with limited mobility or pathology may be unable to participate in plantar pressure data collection via the traditional mid-gait method as this method requires the subject to ambulate about 4-5 steps prior to striking the sensor platform. Additionally, due to variability in step length between gait cycles, getting a clean foot contact with the pressure platform becomes difficult. Collecting pressure data via the two-step method is one solution to expedite the data collection process while also reducing the amount of ambulation required by the patient. The data gathered thus far suggests that, in this lab, the two-step method produced data similar to that of the mid-gait method. Additional subjects need to be collected to strengthen these findings. Similar comparisons of two-step and mid-gait methods, as well as plantar pressure symmetry, are needed in atypically developing children to determine if this study's findings mirror that which would be found in clinical populations.

References:

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