

BACKGROUND

- Spina bifida is a condition with greatly varying severities and clinical outcomes (Marreiros et al., 2014)
- In general, more rostral neural tube defects are generally associated with greater severity of medical comorbidities and functional deficits. (Oakshott & Hunt, 2003)
- Most children with sacral level lesions are expected to become community ambulators and may look functionally typical on clinical evaluation. (Williams et al., 1999)(Brinker et al., 1994).
- Despite this, these individuals are at risk for significant long-term disability secondary to decrease in:
 - foot intrinsic muscles control
 - plantar flexion strength
 - plantar sensation and wound complications (Wilson & Stewart, 2019).
- The use of plantar pressure analysis can provide valuable quantitative and qualitative analysis and may provide more insight into the gait patterns of children with sacral level spina bifida.
- This study is the first ever, to our knowledge, objective and subjective comparison of normative control (HC) plantar pressures to plantar pressures of children with sacral level spina bifida (SSB).

METHODS

- The data was collected retrospectively from The Center for Gait and Movement Analysis at Children's Hospital Colorado
- Variables analyzed were of foot progression angle, lateral index, arch ratio, start location and the continuous variable of center of pressure in the X (medial/lateral) and Y (anterior/posterior) directions. (Figure 1)
- We tested for differences in the summary statistics of gait patterns between the groups adjusting for age and BMI as possible confounders. In order to account for heteroscedasticity, we used robust regression to test these associations.

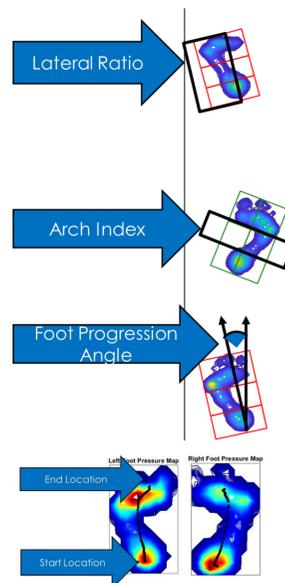


Figure 1. Variable Descriptor

RESULTS

- The mean, minimum and maximum are significantly different for X coordinate of the left foot, while standard deviation, minimum and maximum are significantly different for Y coordinate of left foot ($p < 0.05$). (Figure 2)
- In the right foot only the maximum is significantly different in Y ($p < 0.05$) but not X. (Figure 2)
- Right foot minimum in Y has a confidence interval that does not contain 0 but an adjusted $p = 0.057$
- Foot progression angle, lateral index, arch ratio, start location and end location of the foot did not yield significant differences.

Figure 2. Raw Data

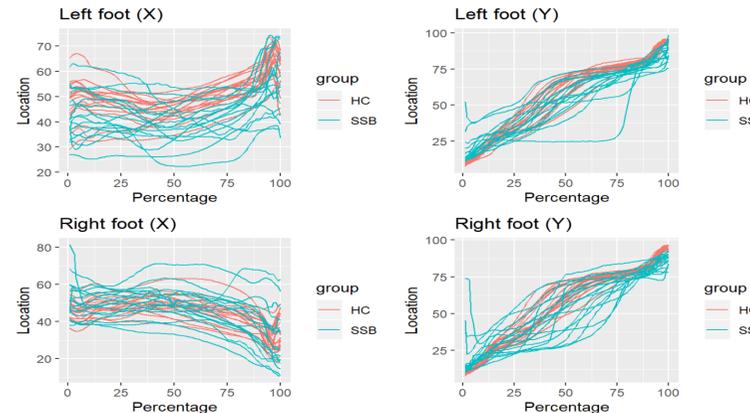


Table 1. Participant Characteristics

Group Averages	Number of Participants	Age in Years	Height in Cm	Mass in Kg
Sacral Patients	17	8.4	123.8	29.6
Control Patients	18	14.9	161.5	55.8

Plantar Pressure Examples

Figure 3a. Control Plantar Pressure

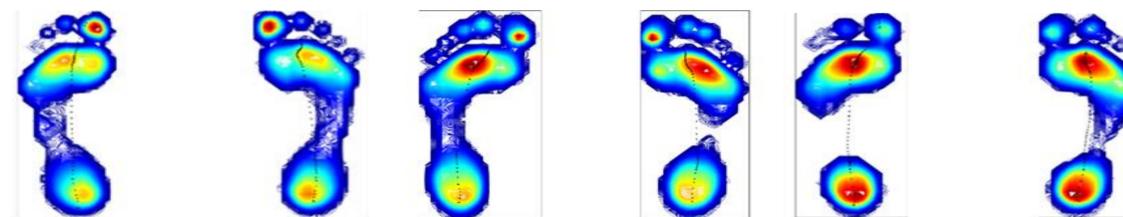
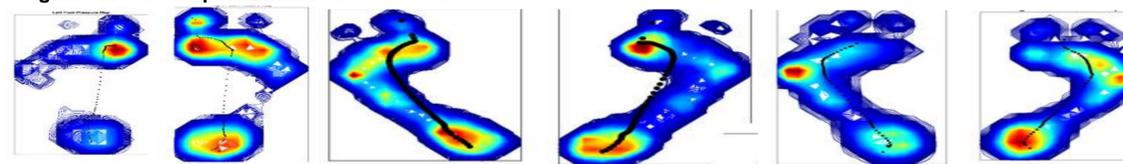


Figure 3b. Sacral Spina Bifida Plantar Pressure



CONCLUSIONS

- There is more variability in the plantar pressure of kids with SSB when compared to the control plantar pressures.
- In the controls, the peak pressure tended to occur at the heel and at the 2nd and 3rd metatarsals while in the SSB patient's the peak pressure occurred more variably around the foot, some medially, some laterally around the forefoot, and some in more spread out throughout the foot and heel.
- The variables that had a significant differences between them in both feet were isolated to the Y plane.
 - The differences in the minimums and maximums for the SSB patients in the Y (anterior/posterior) plane are consistent with a lack of foot intrinsic control throughout the gait cycle leading to instability.
 - The SSB patients tend to use more of the center of there feet yielding higher minimums and lower maximums in both feet.
 - Some variability in X (medial/lateral) was seen but this is less consistent and is less statistically significant since the majority of foot trajectory in this plane is determined by muscle groups above the foot and by muscle groups that are intact for SSB patients
- Future prospective research should be done to further investigate the difference in variability in the Y plane for SSB patients

IMPLICATIONS

- Comparative analysis reveals fundamental differences in the feet of children with sacral level spina bifida. While it is uncertain if plantar pressure will yield information that can aid in clinical risk stratification and decision making for this population, it does show promise for future prospective research.

DISCLOSURES

- Medical Student at University of Colorado Anschutz Medical Campus with No Relevant Disclosures