

# Foot Pressures with and without Bracing in Patients with Cerebral Palsy (CP)

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Limited data exists as to the foot pressure characteristics of patients with CP (with and without bracing). This study examines if bracing improves the distribution of weight through the foot in patients with CP.

## Purpose:

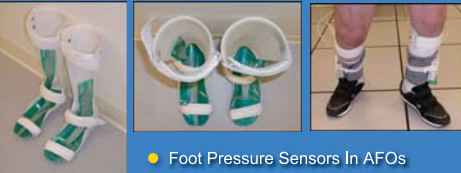
To determine if bracing improves the distribution of foot pressure in patients with Cerebral Palsy.

## Background:

Normal foot pressure is distributed from the heel along the lateral border of the foot to the metatarsal heads. CP foot pressure is typically increased in the forefoot with mid foot breakdown and decreased pressure to the hind foot. Bracing is thought to improve the distribution of weight through the foot.

## Methods:

- Retrospective chart review of pediatric subjects
- Tested from 6/03 through 7/04
- CP patients with and without braces
- Foot pressure studies using the TEKSCAN (Boston, MA)
- AFO, Hinged AFO or DAFO brace
- Shoe condition TEKSCAN between foot and shoe
- Brace condition TEKSCAN between foot and brace



● Foot Pressure Sensors in AFOs

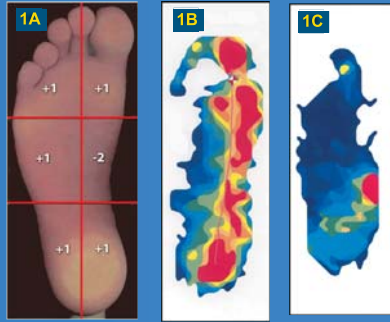


Fig. 1A: **Foot Pressure Scoring Method:**

- The foot was divided into six equal quadrants
- The mid foot was assigned a score of -2
- All other quadrants were assigned a score of +1

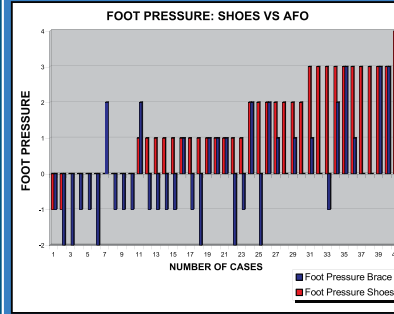


Fig. 1B: ● Medial forefoot, midfoot, hindfoot. Pressure score = 0

Fig. 1C: ● Midfoot breakdown. Pressure score = -2

| Subjects                      | Variables Measured   |
|-------------------------------|--|
| Male 13                       | ■ Foot Pressure Shoe Condition                             |
| Female 10                     | ■ Foot Pressure Brace Condition                            |
| Involved Lower Extremities 41 | ■ Gastroc R1 and R2  |
| Age Range 4 to 18 yrs.        | ■ Hamstring R1 and R2                                      |
| Mean Age 10.39 yrs.           | ■ Maximum Soleus ROM                                       |
| Spastic Diplegia 10           | ■ Minimum Anterior Pelvic Tilt During Gait Cycle           |
| Quadriplegia 1                | ■ AFO, HAFO and DAFO                                       |
| Asymmetric Diplegia 4         | ■ HFFD (Hip Fixed Flexion Deformity) > or = to 10 Degrees  |
| Left Hemiplegia 3             | ■ KFFD (Knee Fixed Flexion Deformity) > or = to 10 Degrees |
| Right Hemiplegia 1            |  |
| Triplesia 4                   |  |

| Paired t-test | Variables     | P Values |
|---------------|---------------|----------|
| With Brace    | Without Brace | < .0001  |
| +HFFD +KFFD   | +HFFD +KFFD   | .0075    |
| With Brace    | Without Brace |          |
| +HFFD -KFFD   | +HFFD -KFFD   | .0004    |
| With Brace    | Without Brace |          |
| -HFFD +KFFD   | -HFFD +KFFD   | .0026    |
| With Brace    | Without Brace |          |
| -HFFD -KFFD   | -HFFD -KFFD   | .0516    |
| With Brace    | Without Brace |          |

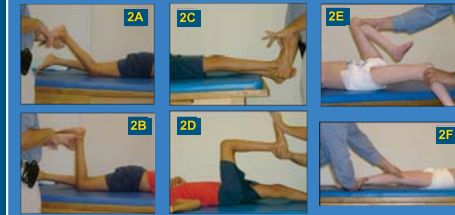


Fig. 2A: ● Hamstring R1  
Fig. 2B: ● Hamstring R2  
Fig. 2C: ● Gastroc Tightness  
Fig. 2D: ● Soleus Length  
Fig. 2E: ● HFFD  
Fig. 2F: ● KFFD

## Results:

The paired t-test between the foot pressure scores with and without braces showed a statistically significant difference ( $p < 0.0001$ ) with the foot pressure score lower in the braced condition. All remaining paired t-test results showed a statistically significant difference ( $p = 0.01$ ) between groups except the pair between the -HFFD and -KFFD. No significant correlations were found between braced foot pressure scores and the gastrocnemius/soleus variables. There was a correlation found between hamstring spasticity and mid foot breakdown in the shoe and brace conditions with linear regression ( $p < .0001$ ).

## Conclusion:

This study indicates that there is no improvement in foot pressure score with customized bracing of the ankle and foot as compared to in shoe foot pressure score. In this series the presence of hip and knee flexion contractures led to poorer foot pressure scores with bracing as compared to shoes alone. Most subjects had lower scores with bracing secondary to mid foot breakdown. Careful analysis and resolution of hip and knee flexion contractures and hamstring spasticity should be addressed before prescribing ankle-foot-orthoses for ambulatory patients with CP.