

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:

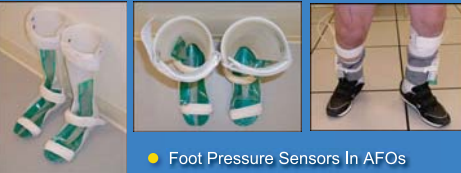
To determine if bracing improves the distribution of foot pressure in patients with Cerebral Palsy.

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

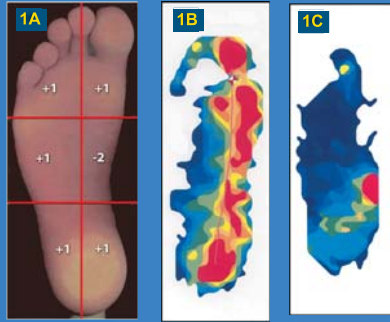


Fig. 1A: Foot Pressure Scoring Method:

- 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

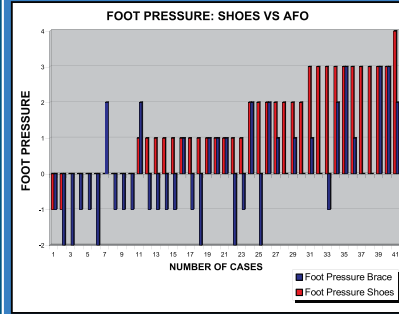


Fig. 1B: ● Medial forefoot, midfoot, hindfoot. Pressure score = 0

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

Subjects	Variables Measured
Male	13
Female	10
Involved Lower Extremities	41
Age Range	4 to 18 yrs.
Mean Age	10.39 yrs.
Spastic Diplegia	10
Quadriplegia	1
Asymmetric Diplegia	4
Left Hemiplegia	3
Right Hemiplegia	1
Triplesia	4

Variables Measured
■ Foot Pressure Shoe Condition
■ Foot Pressure Brace Condition
■ Gastroc R1 and R2
■ Hamstring R1 and R2
■ Maximum Soleus ROM
■ Minimum Anterior Pelvic Tilt During Gait Cycle
■ AFO, HAFD and DAFO
■ HFFD (Hip Fixed Flexion Deformity > or = to 10 Degrees)
■ KFFD (Knee Fixed Flexion Deformity > or = to 10 Degrees)

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	

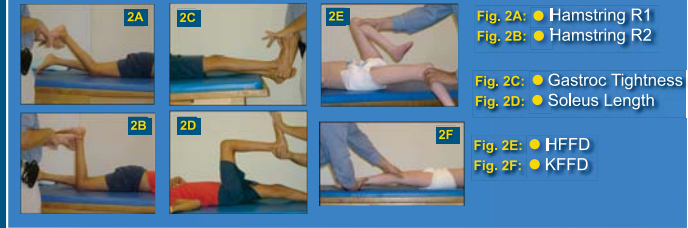


Fig. 2A: ● Hamstring R1
Fig. 2B: ● Hamstring R2
Fig. 2C: ● Gastroc Tightness
Fig. 2D: ● Soleus Length
Fig. 2E: ● HFFD
Fig. 2F: ● KFFD

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.