Effect of Two Orthotic Approaches on Activity Level, Balance & Satisfaction in Children with Cerebral Palsy (CP)

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Background

- Children with CP are at risk of activity limitations and participation restrictions as a result of their impairment(s), affecting their overall health, well-being and quality of life [1].
- Intervention goals include enabling activities and participation [2].
- Orthoses that restrict ankle motion may help impairments such as balance but impose greater activity limitations than those that provide less restriction [3,4].
- Few studies have explored the effect of level of orthotic ankle motion restriction on activity of children with CP [5].

Purpose of the Study:
The purpose of this case series was to evaluate how ankle motion restriction affects balance, activity level, and satisfaction in children with CP.

Methods

Interventions:
Orthoses were made by a single orthotist from the same impression using a wrap of the modified cast.

Complete ankle motion restriction using a solid ankle-foot orthosis-footwear combination (AFO-FC)

VS

Resisted, articulated motion using an adjustable dynamic response AFO with supramalleolar orthosis (ADR-AFO)

Subjects:

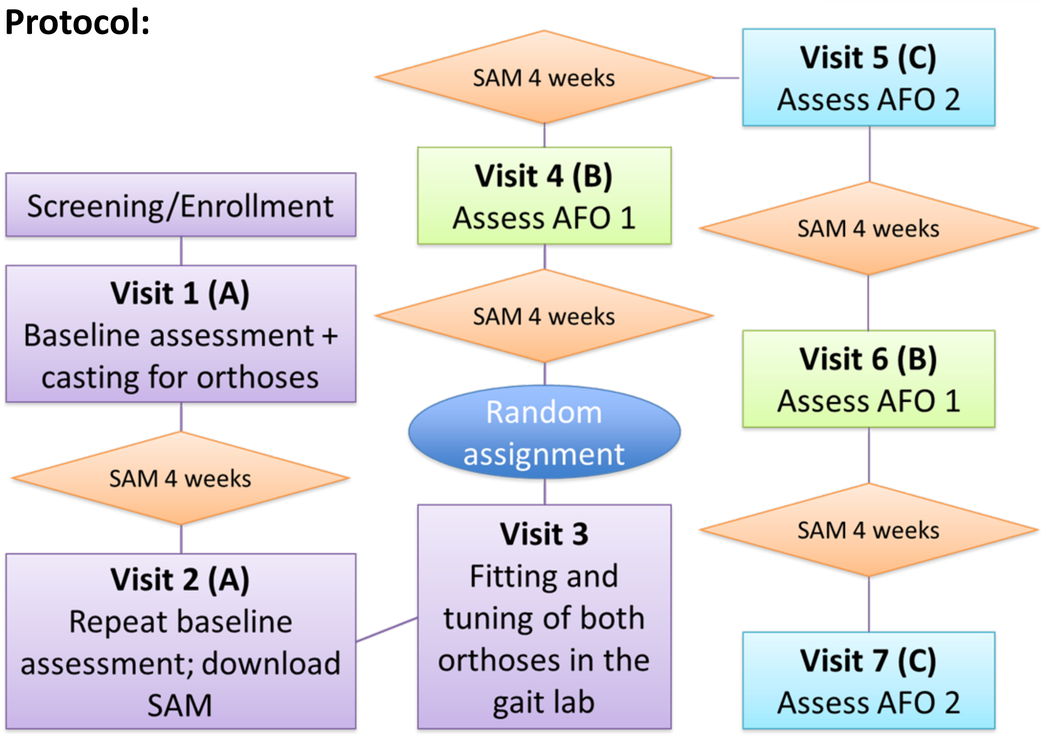
Subject #	Age (years)	Distribution	GMFCS*	Baseline Orthosis
1	6	Hemiplegic	I	Unilateral articulated AFO
2	10	Diplegic	III	R SMO, L DF assist AFO with PF stop (+ walker)
3	6	Diplegic	II	Bilateral articulated AFOs with DF check strap
4	8	Asymmetric Diplegic	II	Bilateral articulated AFOs with DF check strap
5	8	Diplegic	II	Bilateral SMOs

*Gross Motor Function Classification System
SMO=supramalleolar orthosis, DF=dorsiflexion, PF=plantar flexion

Outcome Measures:

- Steps/day (StepWatch, Modus Health LLC, Washington DC, attached to orthoses)
- Balance (Pediatric Balance Scale, PBS)
- Satisfaction with device (SwD module of the Orthotic and Prosthetic Users' Survey, OPUS)

Protocol:

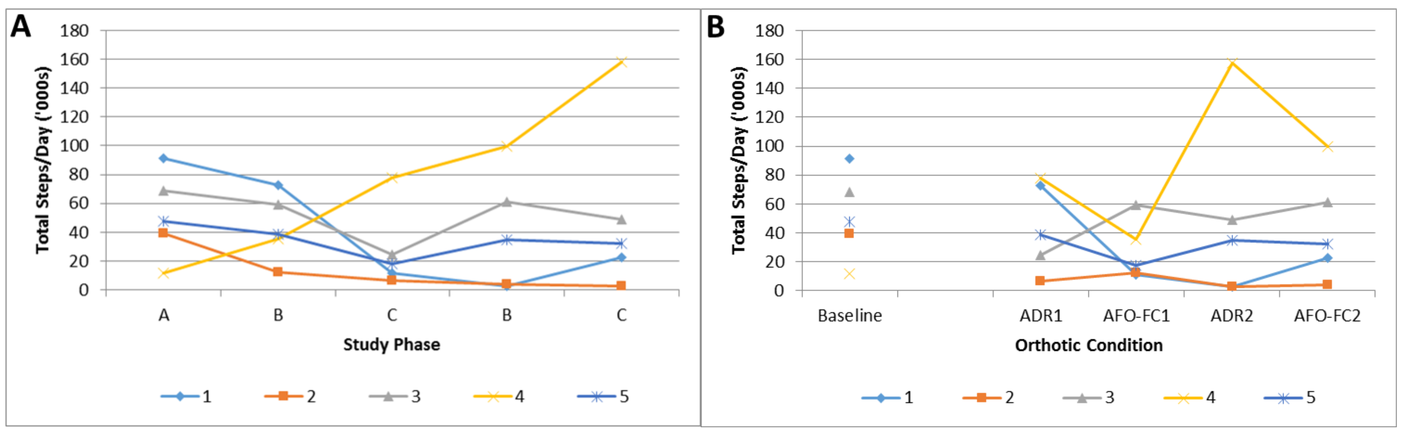


Randomized cross-over before and after trial (AABCBC design)

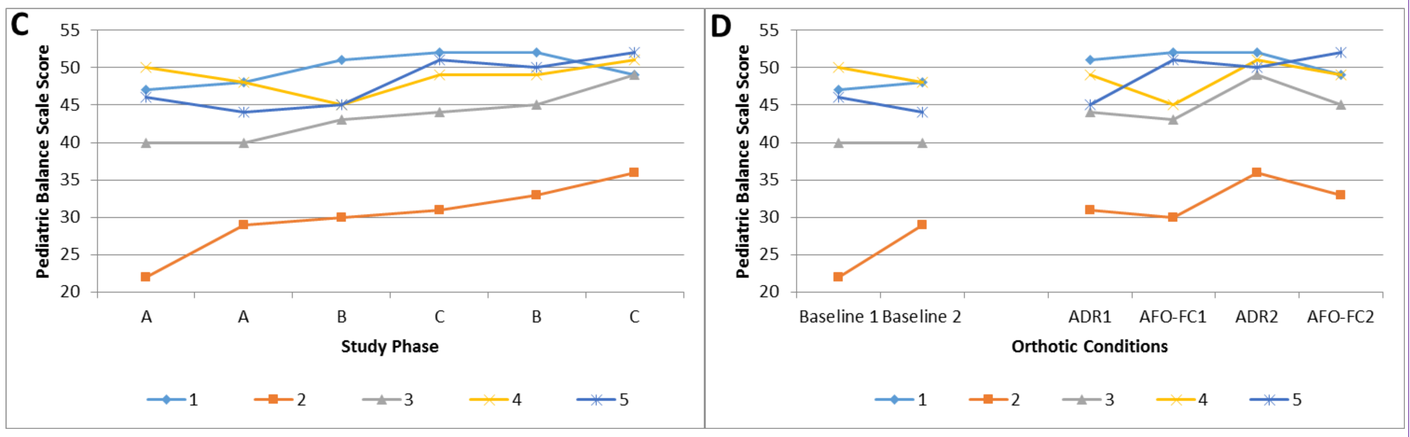
Analysis:
Descriptive analysis of time series data in chronological order to allow for assessment of any order effects and then by orthosis.

Results

- Subjects spent most of their time inactive with low to moderate step activity when active. Only the hemiplegic and asymmetric diplegic subjects had some high step activity rate (Fig A). With the exception of the asymmetric diplegic subject, all subjects walked less steps/day in both test orthoses than they did in their originally prescribed orthoses (Fig B).



- Balance seemed affected more by time in study (Fig C) than orthosis design (Fig D) with 3 subjects demonstrating clinically important change over time (MCID = 3.66 - 5.83) [6].



- Results for satisfaction with device were inconsistent.

Conclusions

- Transition from DF free device to ankle motion restricted device takes time; subjects may have benefitted from dedicated therapy, which was not provided as part of study.
- Degree of ankle motion restriction did not seem to matter, but some restriction helped with balance perhaps by helping strengthen more proximal muscles given gains occurred over time.
- Activity level was reduced with increased restriction of ankle motion, with decreased wear reported verbally during periods when subjects were most active (e.g. sporting activities).
- Mixed effect of orthoses not only across subjects but within the same subject based on different measures suggests:
  - The idea that orthotic benefit might be situation/task specific
  - The potential utility of bimodal or multi-modal AFOs
  - The use of time and resources to customize orthotic intervention

References:

[1] Calley et al, Disabil Rehabil, 34(15):1306-10, 2012. [2] Morris C, Condie D. Recent Developments in Healthcare for Cerebral Palsy. ISPO Report 2009. [3] Morris C. Dev Med Child Neurol, 44(3):205-11, 2002. [4] Ramstrand N & Ramstrand S. J Prosthet Orthot 10(Proc):4-23, 2010. [5] Harvey et al, Dev Med Child Neurol, 50(3):190-8. 2008. [6] Chen et al. Res Devel Disabil, 34:916-22, 2013.

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