

# Sorting Out Dystonia and Spasticity in CP using 3-D Gait Analysis

## Implications for Stiff-Knee Gait, Toe Walking, & Rhizotomy "Candidates"



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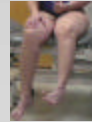
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### Background

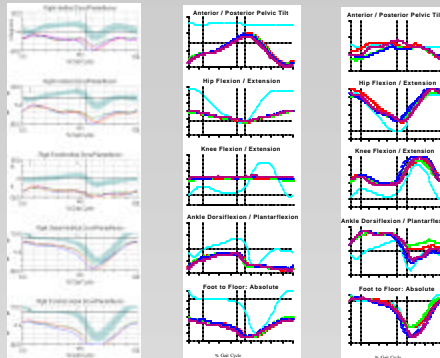
Individuals with CP are typically described as spastic, often with "severe spasticity", when they actually have a significant component of dystonia. Accurate identification of dystonia is crucial because treatment options such as rhizotomy and orthopaedic surgical procedures may have unpredictable outcomes in individuals who have a combination of dystonia and spasticity.



### Clinical Exam Sorting

Signs to Sort By	Dystonia	Spasticity
Posturing at rest (great toe extension, foot inversion)	+	-
Positional changes elicit posturing (prone, fast gait)	+	-
Increased resistance throughout <b>entire</b> joint PROM	+	-
Increased resistance to <b>slow</b> joint PROM	+	-
Increased resistance to <b>fast</b> joint PROM	++	+
Increased resistance to PROM in joint <b>flexors</b>	+	+
Increased resistance to PROM in joint <b>extensors</b>	+	-
Triggers may cause <b>overflow</b> , associated reactions	+	-
Facial grimacing, tongue thrusting, muscle spasms	+	-
"Body-Builder" appearance; muscles strong	+	-
Presence of torticollis or truncal rotation posturing	+	-
Selective Motor Control (SMC) intact distally	+/-	-
Hypertonia present during sleep	-	+
Pyramidal signs: Clonus, Babinski, DTRs	-	+
Onset of dystonic or spastic muscle tone	<b>age 5-15</b>	<b>in 1st year</b>
Classification Scales	Dystonia	Spasticity
Barry Albright Dystonia (BAD) Scale	+	-
Hypertonia Assessment Tool - Discriminant (HAT-D)	+	+
Tardieu / Modified Tardieu Scale (R1-R2)	-	+
Ashworth / Modified Ashworth Scale (MAS)	-	+

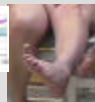
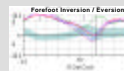
### Kinematic Sorting



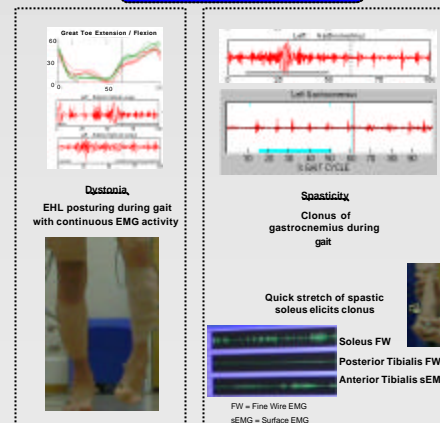
**Dystonic Toe Walking**  
Reduced hindfoot and forefoot excursions

**Hemidystonia**  
Reduced joint excursions at all levels

**Spasticity**  
Spastic diplegia with crouched gait



### EMG Sorting



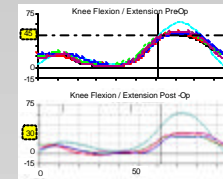
**Dystonia**  
EHL posturing during gait with continuous EMG activity

**Spasticity**  
Clonus of gastrocnemius during gait

Quick stretch of spastic soleus elicits clonus

Soleus FW  
Posterior Tibialis FW  
Anterior Tibialis sEMG  
FW = Fine Wire EMG  
sEMG = Surface EMG

### Stiff-Knee Gait



18 year old female with dystonia + spasticity (BAD score 3/32) two years after rectus femoris lengthening. Note 15-degree loss of swing-phase knee flexion after surgery.

### Why Sort?

- In CP...it's not just spasticity!! Look for dystonia, too.
- More individuals with CP have mixed tone than was formerly thought; accurate identification critical for clinical decision-making.
- Rectus transfer or lengthening** for stiff-knee gait in the dystonic individual may lead to reduced joint excursion at the knee
- Toe walking** may be due to transient dystonia; heelcord lengthening may not be indicated
- Rhizotomy** may only be indicated in pure spasticity
  - Dystonia may not appear until ages 5- 15
- Intrathecal baclofen (ITB) pump** effective for dystonia *and* spasticity
  - May need much higher doses of ITB for dystonia
- Botox** effective in dystonia *and* spasticity
- Role of **systemic medications** (e.g. Sinemet, Artane) for management of dystonia in CP?

Evaluation in the Motion Analysis Laboratory –  
Extremely Useful for Sorting!  
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