

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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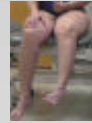
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Background

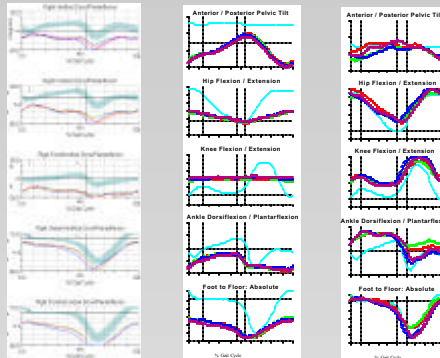
Individuals with CP are typically described as spastic, often with "severe spasticity", when they actually have a significant component of dystonia. Accurate identification of dystonia is crucial because treatment options such as rhizotomy and orthopaedic surgical procedures may have unpredictable outcomes 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 entire joint PROM | + | - |
| Increased resistance to slow joint PROM | + | - |
| Increased resistance to fast joint PROM | ++ | + |
| Increased resistance to PROM in joint flexors | + | + |
| Increased resistance to PROM in joint extensors | + | - |
| Triggers may cause overflow , 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 | age 5-15 in 1st year | |
| 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) | - | + |

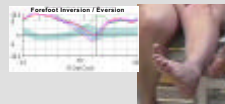
Kinematic Sorting



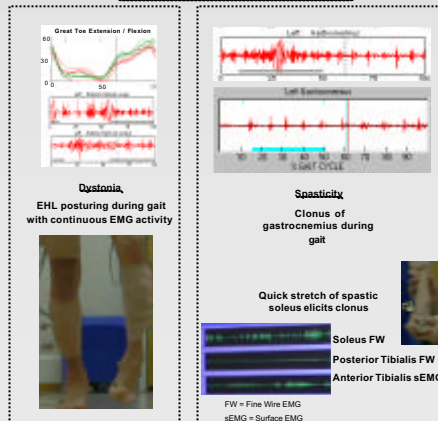
Dystonic Toe Walking
Reduced hindfoot and forefoot excursions

Hemidystonia
Reduced joint excursions at all levels

Spasticity
Spastic diplegia with crouched gait



EMG Sorting



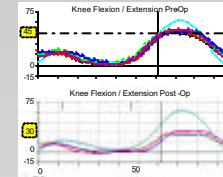
Dystonia
EHL posturing during gait with continuous EMG activity

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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