The Use of an Orthotic Garment System on a Pediatric Patient with Mitochondrial Disease Complex 1+3: A Case Report
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Background
- Mitochondrial Disease (MD) is a progressive and debilitating disease that is characterized by a loss of efficiency in the electron transport chain and reductions in the synthesis of high energy molecules such as ATP.
- Orthotic garment systems also referred to as “TheraTogs®”, have been designed to act as a continuous somatosensory guide for proper functional alignment.
- Theratogs have been used in the pediatric population to treat Cerebral Palsy and Down Syndrome with excellent results but there is no known research regarding the benefits of TheraTogs® in individuals with MD.

Purpose
- To investigate the use of the TheraTogs® System for postural control, with a pediatric patient with Mitochondrial Disease Complex 1+3.

Patient History
- The patient was an 11-year-old child with a primary diagnosis of MD Complex 1+3. The patient presented with bilateral foot over-pronation, lower extremity internal rotation, knee hyperextension, increased hip flexion, and increased lumbar lordosis in standing. Impairments included decreased muscle strength, endurance and balance, impaired posture and abnormal muscle tone.

Examination

| Cardio/Pubn | BP: 100/62
| Imaginary  | Normal S2, S2
| Height/weight | 64.4 in, 4 feet 6 in
| BMI 11.5
| Position | Bilateral foot over-pronation
| Increased bilateral hip flexion
| Increased lumbar lordosis
| Pivoting weight right and increases trunk flexion when fatigued during ambulation and standing
| Gross ROM | Normal
| Lt: Noted bilateral hamstring tightness
| Rt: Bilateral hip flexion
| Strength | Decreased strength (globally)
| Tone | Increased bilateral LE, trunk tone
| S GT | Mildly ataxic. Walks briskly with occasional loss of balance on even surfaces and frequent loss of balance on uneven surfaces with bilateral AFO’s. Bilateral in testing with increased promotion

<table>
<thead>
<tr>
<th>Impairments</th>
<th>Functional Limitations</th>
<th>Disabilities</th>
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<tbody>
<tr>
<td>Decreased strength</td>
<td>Abnormal gait pattern</td>
<td>Unable to participate in age appropriate recreation activities</td>
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<tr>
<td>Increased LE muscle tone</td>
<td>Difficulty ascending and descending stairs</td>
<td>Unable to participate in activities that require transitioning from the floor to standing</td>
</tr>
<tr>
<td>Decreased LE muscle tone</td>
<td>Difficulty maintaining static postures required to transition from floor to standing</td>
<td></td>
</tr>
<tr>
<td>Impaired balance, coordination, posture, trunk control and gait</td>
<td>Difficulty maintaining static postures required to transition from floor to standing</td>
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<tr>
<td>Limited Endurance</td>
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Interventions

<table>
<thead>
<tr>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Session 6</th>
<th>Session 7</th>
<th>Session 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick knee tag test</td>
<td>Quick weighted knee test</td>
<td>Single leg stance test</td>
<td>Quick weighted knee test</td>
<td>Single leg stance test</td>
<td>TheraTag walk</td>
<td>TheraTag step training with square pads</td>
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<tr>
<td>Quick weighted ball toss</td>
<td>1/2 knee weighted ball toss</td>
<td>High 1/2 knee with fine motor activities</td>
<td>High 1/2 knee weighted ball toss</td>
<td>High 1/2 knee weighted ball toss</td>
<td>TheraTag adjustment</td>
<td>TheraTag stance needed to be weighted</td>
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<tr>
<td>Shuts</td>
<td>Bilateral moving push off</td>
<td>Quick weighted ball toss</td>
<td>Step膝 with soccer ball</td>
<td>SLB or uneven surface</td>
<td>Speed walking on uneven surface</td>
<td>SLB</td>
<td>High 1/2 knee weighted ball toss</td>
</tr>
<tr>
<td>Gait training with squish pads</td>
<td>High kneel/quadricep strength</td>
<td>High kneel quadriceps strength</td>
<td>Step knee with soccer ball to target</td>
<td>Single leg stance test</td>
<td>Over knee (knee in target, each side)</td>
<td>Calf weight bear and anteroposterior moving on wedge</td>
<td>Single leg stance test</td>
</tr>
<tr>
<td>Treadmill</td>
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<td>Treadmill</td>
<td>Kneeling start/stop to target</td>
<td>Target</td>
<td>Reciprocal scrubbing, bear walking - seated</td>
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Outcomes
- With support of the TheraTogs®, the patient was able to perform all activities with improved postural control and endurance.
- Following 8 weeks of treatment, the patient was able to get into each test position independently and also independently maneuver stairs, curbs and ramps and was becoming more engaged with peers.

Discussion
- The use of TheraTogs improved alignment, functional ability, and endurance in an 11-year-old pediatric patient with MD Complex 1+3.
- Further research should focus on investigating the benefits of TheraTogs® in younger and older patients with Mitochondrial Disease.

References