Using Orthotics to Advance Motor Skills in a Child with Noonan's Syndrome: a Case Report
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**Background and Purpose:** The purpose of this case report is to describe the impact of the use of orthotics on the gross motor skills of a 3 year old child with Noonan Syndrome. Low muscle tone and muscular weakness, which are common symptoms in children with Noonan Syndrome, can lead to difficulty with gross motor skills that require propulsion and balance. It was hypothesized that improved biomechanical alignment of the foot and ankle through the use of orthotics would enhance gross motor skill.

**Case Description:** The child was provided with bilateral supramalleolar orthotics (SMO’s) and participated in an 8 week intervention program consisting of strengthening and balance exercise, developmental training, and practice of motor skills. SMO’s are lower extremity braces that provide hind foot, mid foot and forefoot control. The SMO’s that were fabricated for this child provided control from just above the ankle to the metatarsal heads. Outcome measures included the Peabody Developmental Motor Scales-2 (PDMS-2) to quantify gross motor changes, a pedograph to measure gait parameters, and parent interview. These measures were taken pre, post and at follow up sessions both with and without orthotic wearing.

**Outcomes:** After 8 weeks of wearing orthotics during all upright weight bearing activities, the child demonstrated improved scores on all parameters of the PDMS-2, improved gait characteristics on the pedograph, and increased gait speed while wearing the orthotics. Additionally, through interview, the child’s family reported satisfaction with the outcomes. From baseline testing to week 8 data collection with orthotics, a 23.6% increase was noted in the subject’s gross motor quotient on the PDMS-2. Measurements from the pedograph indicated that step length increased by 101%, step width decreased by 11.9%, and stride length increased by 84.6% on the left and by 48.3% on the right. Running speed over a 45 foot distance also showed improvement, decreasing from 9 seconds at baseline to 5.1 seconds. Results from the parent interview indicated that the child exhibited decreased complaints of foot pain, decreased difficulty with functional motor skills and improvements with keeping up with peers in recreational and school based activities. Improvements were also seen after 8 weeks when the child was tested without wearing orthotics as compared to baseline. When compared to baseline testing, GMQ on the PDMS-2 improved by 12.5%, step length improved by 101.9%, step width decreased by 42.3%, and stride length increased by 93.3% on the left and by 50% on the right. Running speed over a 45 foot distance was 5.3 seconds.

**Discussion:** Providing external supports in the form of SMO’s for a 3 year old child with Noonan Syndrome brought about an improvement in gross motor and mobility skills as measured by standardized testing and subjective interview. Such improvement may be related to improved biomechanical alignment provided by the SMO’s and consequential motor learning when not wearing the SMO’s after training. This adjunct should be considered for other children experiencing low muscle tone and difficulty with skills, especially those requiring propulsion and balance. More research is needed to determine the impact of orthotic intervention on other populations.
**Summary of Outcome Measures:**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Change from Baseline with Orthotics</th>
<th>Change from Baseline without Orthotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMQ (PDMS-2)</td>
<td>23.60%</td>
<td>12.50%</td>
</tr>
<tr>
<td>Step Length</td>
<td>101.00%</td>
<td>101.90%</td>
</tr>
<tr>
<td>Stride Length Left</td>
<td>84.60%</td>
<td>93.30%</td>
</tr>
<tr>
<td>Stride Length Right</td>
<td>48.30%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Step Width Decrease</td>
<td>11.90%</td>
<td>42.30%</td>
</tr>
<tr>
<td>45 Foot Running Speed Decrease</td>
<td>43.30%</td>
<td>41.10%</td>
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</tbody>
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Results from the parent interview after the child had worn the orthotics for 8 weeks indicated that the child exhibited decreased complaints of foot pain, decreased difficulty with functional motor skills and improvements with keeping up with peers in recreational and school based activities.