Case Study: Development of a trunk orthosis with dynamic flexion assist in an individual with Arthrogryposis
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Introduction:
Arthrogryposis is a term used to describe multiple congenital contractures affecting multiple parts of the body, typically due to neurologic, muscle, or connective tissue abnormalities or other issues such as intrauterine space constraint, vascular compromise, maternal disease, and teratogenic exposure. Treatment can involve intensive exercise program, serial casting, and orthotic intervention. Many orthoses are positioning devices to maintain the range gained from casting or surgery (Williams 1985).

Patient History
The individual, a 12 m/o old male with a history of arthrogryposis multiple congenital, was seen at Rehabilitation Institute of Chicago (RIC). He presented with limited upper extremity motion with the elbows in full extension and forearms in slight pronation. The patient’s goals focused on developmental play, improving functional reach and grasp, and bimanual coordination for self-feeding. Previous orthotic intervention was a device made from heat moldable plastic, bilateral shoulder cuffs, strapped across the chest, and elastic bands connected anteriorly from the shoulder cuffs to resting hand splints. A new device was desired to facilitate more shoulder and elbow flexion without impeding on elbow extension encouraging play and self-feeding.

Method:
A “vest style” orthosis with dynamic flexion assist was developed to cross the shoulder joint for stability but not constrict volitional core motion.

A single step impression was taken with patient seated using rigid plaster and the device was fabricated at RIC. Polypropylene (3/32”) with plastic corrugations was pulled over the positive model with a 1/8” plastizote liner. Custom Benik model w-303 was used for the wrist hand component with minor modifications. Elastic laces were used as the tension component (see figure 1-3). The vest terminated at approximately at the first rib, posteriorly at waistline, and encompassed the posterior ribs to mid-axillary trochanteric line.

Results:
The individual demonstrated the ability to sit with minimal support, pick up toys, hold them at midline, and bring them to his mouth with minimal support (see figures 4). The mother stated he was now able to play independently.

Measurements of ROM in and out of the vest were (see table 1). Increased left active shoulder flexion was seen without the orthosis on due to compensatory motions. The orthosis allowed simultaneous flexion of the shoulder and elbow.

Table 1: Individuals active range of motion in and out of orthosis

<table>
<thead>
<tr>
<th>Patient’s Active ROM (in Degrees)</th>
<th>Out of Vest</th>
<th>In Vest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow</td>
<td>Shoulder</td>
<td>Elbow</td>
</tr>
<tr>
<td>Right</td>
<td>Aprox 0-20</td>
<td>80</td>
</tr>
<tr>
<td>Left</td>
<td>Aprox 0-20</td>
<td>64</td>
</tr>
</tbody>
</table>

Conclusion:
To our knowledge there is no documentation of a device that is dynamic in nature that has been shown to benefit this pediatric population. The orthosis allowed the individual to better interact with his environment by assisting shoulder and elbow flexion. The individual’s active ROM appeared to improved bilaterally, however, we cannot rely on these numbers due to the individual’s age, willingness to participate, and hold positions.

Clinical application:
It is not yet known the long-term effect or populations that might benefit from this design. Further studies will need to be conducted for potential use in other pathologies and age groups.

References:
Williams PF.