**Seated Trunk Stabilization Device**

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| 1 Biomedical Engineering, 2 Chemical Engineering, 3 Material Science, 4 Mechanical Engineering, 5 Design |

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**Problem**

- Hypotonia is characterized by low muscle tone
- Often diagnosed in childhood but can be present in adulthood
- Symptoms include: poor control of neck, postural issues, & pelvis tipped back
- 6% had significant impairments
- Common coexisting conditions: Cerebral Palsy, Muscular Dystrophy, & Down Syndrome
- 6 out of 1000 children in the United States
- Treatment & Management: physical therapy and postural support devices
- Bulky, expensive equipment with limited adjustability over patient growth
- Without proper pediatric intervention, hypotonia can present in adolescence and adulthood

**Need**

Our need is a device that increases stability for pediatric patients with trunk muscular hypotonia in order to ease execution of seated activities of daily living and adjusts throughout the patient’s growth. We narrowed this need down into four main goals we hope to achieve with our project. Goals are as follows:

1. Support a wide range of severity in hypotonia
2. Support seated activities of daily living
3. Adjust with growth of the patient between ages of 4-8
4. Fixated device onto patient without help from practitioner/therapist

**Existing Solutions and Patents**

**Existing Solutions**
1. Bank Vest
   - Two piece neoprene vest with adjustable velcro straps in the shoulder, waist, and crotch.
   - Difficult to put on, too hot, quickly outgrown
2. Thoracic LumboSacral Orthosis
   - Custom molded rigid or semi-rigid plastic brace to support the entire trunk.
   - Expensive, uncomfortable, quickly outgrown

**Patents**
1. Private Label Creations: Back Belt
   - Back brace for supporting lumbar region during strenuous athletic activity to prevent muscle damage
   - Status: Active
2. AMEI Technologies: Brace with integrated lumbar support system
   - Brace with inflatable lumbar pad to provide support to the lumbar region and alleviate lower back pain
   - Status: Expired

**Proposed Solution**

While the design of our proposed solution is very similar to our prototype, there would ideally be some material changes. Because of the use of the belt to keep the patient’s torso up, the material of the belt would be more rigid to add extra support.

**Inflatable device**

**Adjustment knobs for inflatable device**

**Main structure of belt made of canvas material**

**Adjustable straps for the belt**

**Deflated neck vest inflated (top) and deflated (bottom)**

**OurPrototype**

- Hypotonic 8 year old
- Valve that can be connected to the pump

**Reimbursement & Cost**

<table>
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<tr>
<th>Insurance type</th>
<th>Reimbursement?</th>
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<tbody>
<tr>
<td>Medicare Spending Account (MSA)</td>
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<td>Health Savings Account (HSA)</td>
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<td>Health Reimbursement</td>
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<td>Health Insurance</td>
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**Material Component**

- Bag fabric for inflatable belt
- Velcro
- Seat belt and elastic material
- Valve
- Plastic Dome
- Microfibers

**Estimated Cost**

- $0.22/valve
- $0.04/m
- $0.27/m²
- $0.1/m
- $0.21/m
- $0.15/m

**Estimated Cost (total)**

- $3.29

**Evaluation**

“*The efficacy of treating low tone with orthosis is very poorly studied, but it’s the standard of care because I feel intuitively that we can help these kids, and because we’ve seen good clinical results.*”

-Kathy Martin, PT, DHS

Three metrics will ensure that the device meets functional specifications:

1. Ability to raise a hypotonic child to an upright seated position (60° from femur)
2. Maintenance of upright position over an appropriate amount of time
3. Universal usability

Run deflation test to find time which the inflatable can exert force under a known weight

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**References**