**Dynamic Sock Brace for Clubfoot**

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### Background:
Clubfoot is a physical deformity in which an infant is born with one or both feet turned inward. While occurring in 1/1000 births, clubfoot is treatable through bracing.

The most widely-used treatment method is the Ponseti Boots and Bar, which connects both feet together and holds them at a specific angle.

### Key insights from parents and clinicians:
- Boots & bar brace is very effective at holding the correct angle.
- Kids can't roll over at night due to the bar and will wake up screaming and afraid.
- Boots and bar are loud and startle kids if they hit a crib wall.
- Difficulties with wearing boots and bar at night leads to non-compliance in bracing and increased risk of relapse.

### Team Need Statement:
Children with clubfoot need a way to move their legs independently to increase compliance with wearing their brace.

### Solution:
Our design consists of a "sock" filled with polystyrene beads that the user hardens into a brace by pumping the air out of the sock.

1. **Shaped brace with vacuum**
   - We were able to shape the brace to the foot and ankle using a heat sealer. The prototype hardened effectively for an hour.

2. **Shaped brace with additional release valve**
   - This prototype better formed to the foot, was easier to manually soften due to the addition of a release valve and held its stiffness for a couple of hours.

**Alignment Mat**
Each brace comes with an alignment mat which allows parents to set the angle of their child's affected foot at home before removing air from the sock.

**Secure Ankle Angle**
is set using the alignment mat and holds for ~12 hours

**Inflation valve**
allows air back into the system to remove brace

**Polystyrene beads**
compact under vacuum to form a stiff yet lightweight shell

**Mat prototype**
The mat was designed in CAD and 3D printed. The yellow disks can rotate to align at a certain angle relative to each other.

### Development Journey

1. **Shaped brace with vacuum**
2. **Shaped brace with additional release valve**

**1-Way Suction valve**
to remove air from the sock and seal in position

**Electronic hand pump**
pulls air through the 1-way valve

**Removable soft vinyl**
enhances the inside of the brace is comfortable and that the material can be washed

**Removable, washable soft vinyl inner liner**
to reduce the risk of puncturing the sock

**Fuzzy sock outer liner with animal to ensure comfort and kid-friendliness**

**Aesthetic Model**

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