Pluto Brace for Clubfoot

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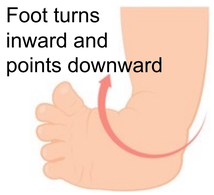
Johns Hopkins Whiting School of Engineering

MultiD Multidisciplinary Engineering Design

1 Design Challenge

Clubfoot is a developmental disorder where a developing foot turns into a clubfoot during pregnancy.



Mitchell-Ponseti Boots and Bars brace: the current standard of care to treat clubfoot

Challenge: create a radically different design for clubfoot bracing that would yield higher rates of adherence to bracing schedules and therefore prevent relapse in clubfoot patients.

Research focus areas: Patient families, clubfoot clinicians, the Ponseti treatment method, brace options on the market

1. **Patients** are uncomfortable when both feet are attached to a bar, especially when sleeping.
2. **Parents** dislike their children being attached to a bar, especially when only one foot is being treated for unilateral patients.
3. **Clinicians** struggle with maintaining patient/parent compliance to the bracing regimen. Research must show that new braces maintain external rotation in the ankle in relation to the leg in order to ensure effectiveness.

Need Statement developed by the team:

Clubfoot patients need a way to wear their brace comfortably, especially during sleep, because brace discomfort results in a lack of compliance and is leading to relapse.

Meet the Team

Daniel Deng: mechanical engineering, 2023
Claire Olivas: chemical and biomolecular engineering, 2022
Kate Saperstein: biomedical engineering, 2023
Alyse Tran: mechanical engineering, 2023

Scan QR code to view our short project video

2 Prototyping & Testing

Figure 1—Prototype Iterations

Figure 2—User Feedback

3 Solution

Pluto Brace: bar-less, spring-loaded brace that allows both unilateral and bilateral patients independent movement of their feet

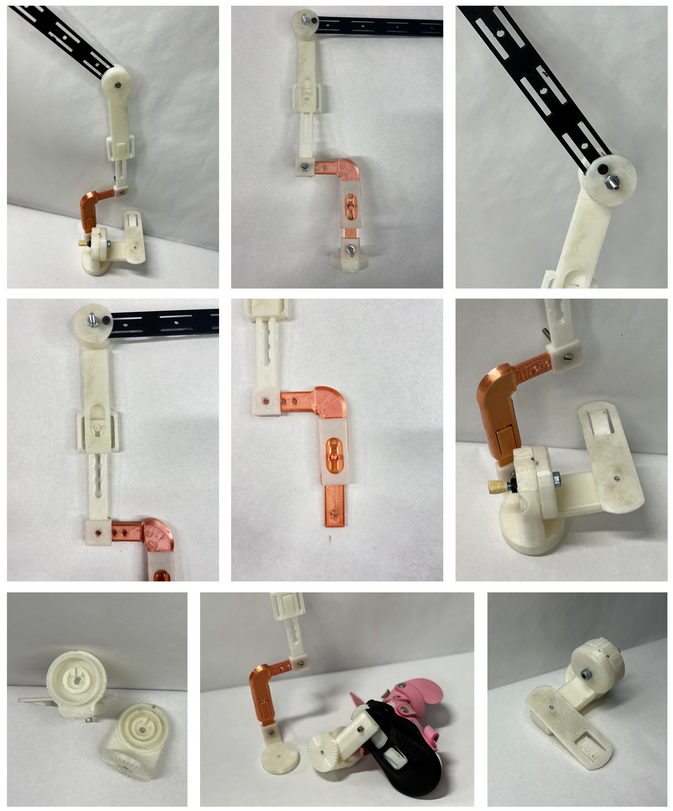
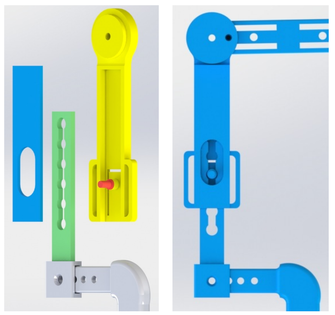


Figure 3—Pluto Brace

Neoprene **thigh and calf cuffs** to firmly and comfortably secure the brace

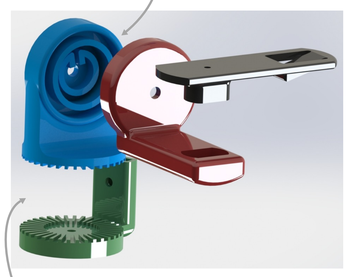
Knee hinge allows for knee mobility

Extendable calf support to accommodate for children's growth



Extendable calf rod, exploded and side views

Torsion spring pushes foot upward, ensuring that the foot does not point downward and resist treatment



External rotation mechanism that clinicians can adjust the rotation angle of for personalized treatment

Snaps in and out of the existing Ponseti boot, allowing for easy integration with existing system