

# Enhancing Patient Compliance for Adolescent Idiopathic Scoliosis Bracing

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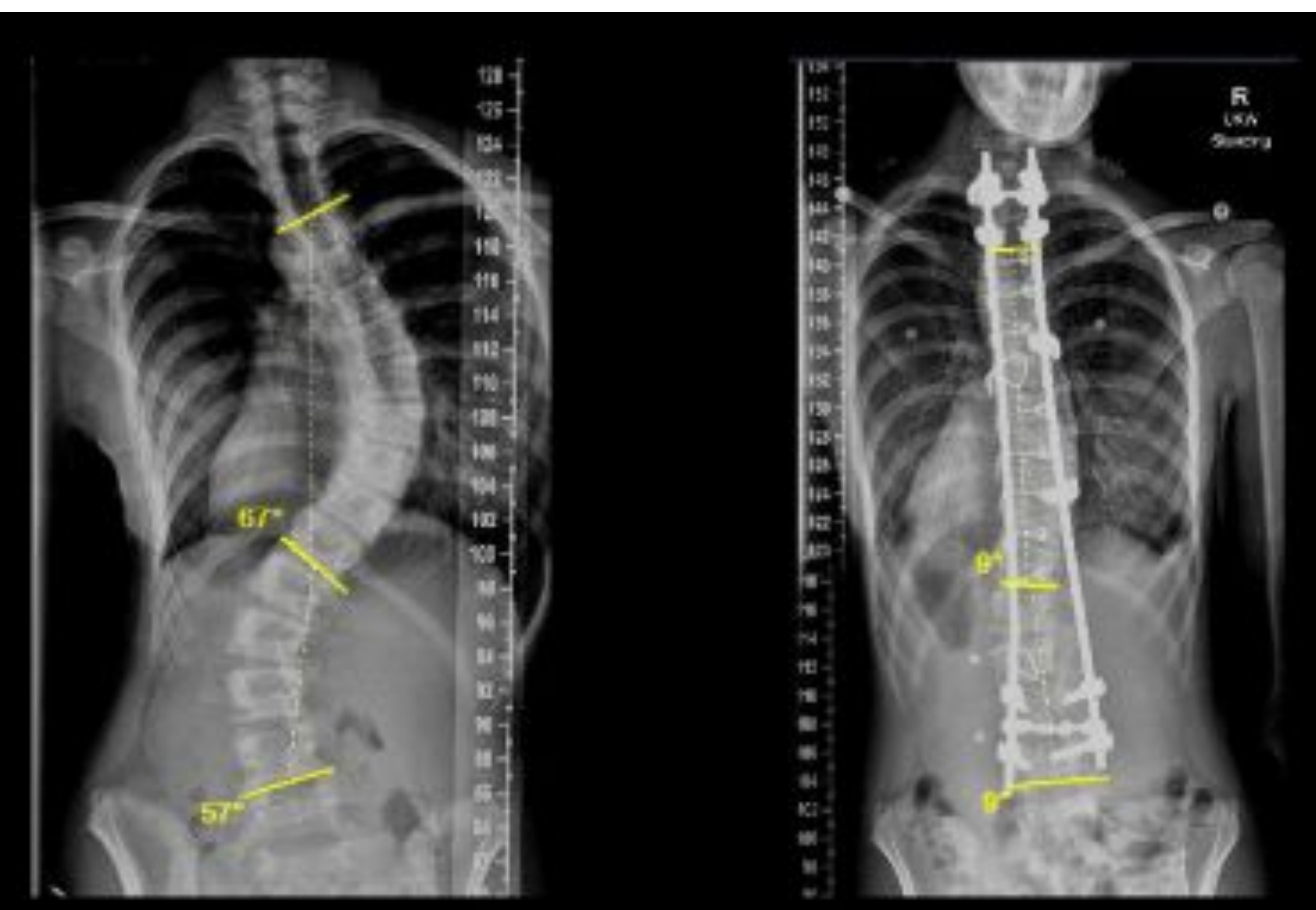
## Introduction/Design

### Adolescent Idiopathic Scoliosis (AIS)

- **Prevalence:** Affects approximately 1–4% of adolescents, representing a major pediatric orthopedic concern.
- **Description:** Characterized by a progressive lateral curvature of the spine that, if untreated, can lead to chronic pain, functional impairment, and decreased quality of life.

### Current Treatment Challenges

- **Insufficient Efficacy:** Brace effectiveness relies on consistent wear, but adherence is often low.
- **Discomfort:** High pressure areas cause irritation and soreness, reducing wear time.
- **Visibility:** Bulky design impacts self-esteem and discourages use.
- **Mobility Limits:** Braces restrict movement, making daily activity harder.
- **Low Adherence:** Only 33–77% of prescribed hours are typically achieved.

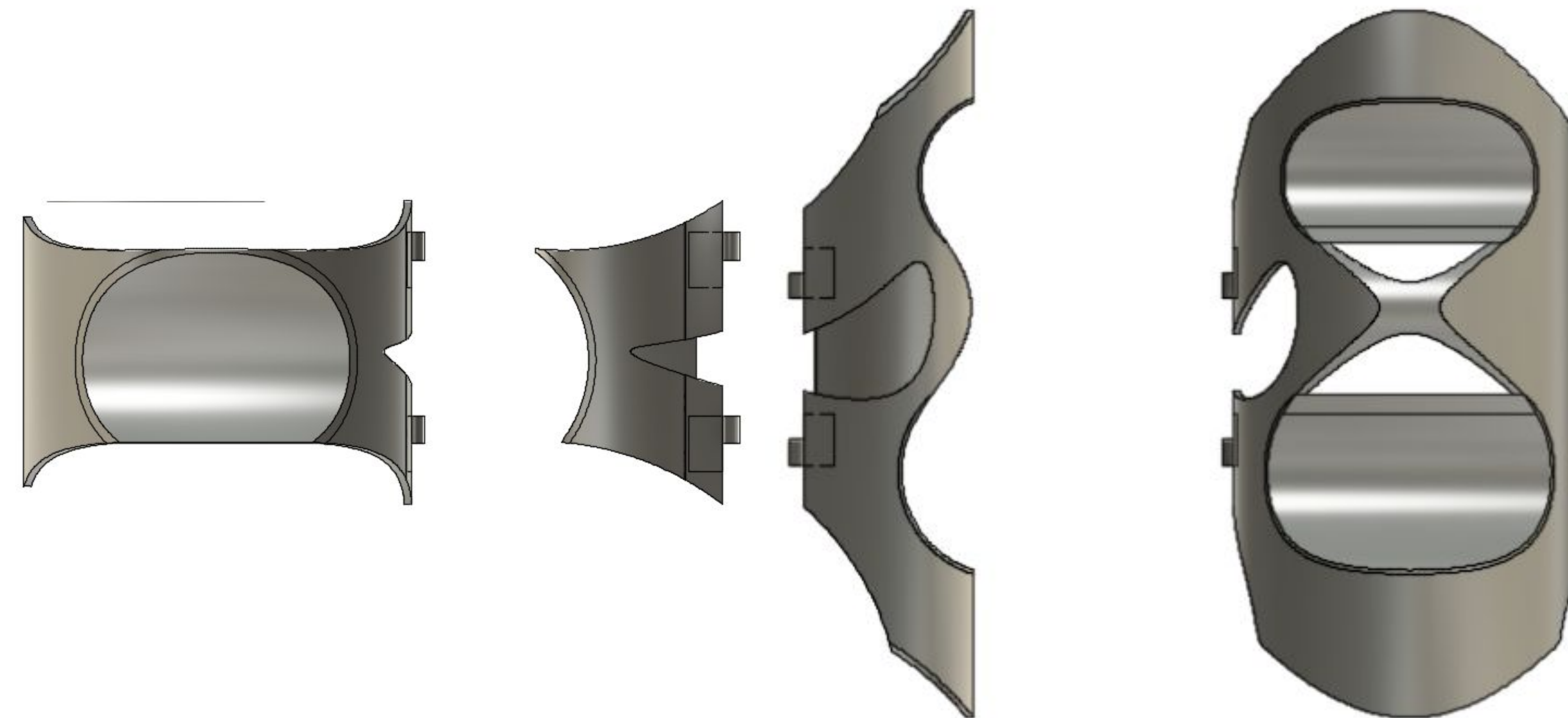


### Our Project Solution

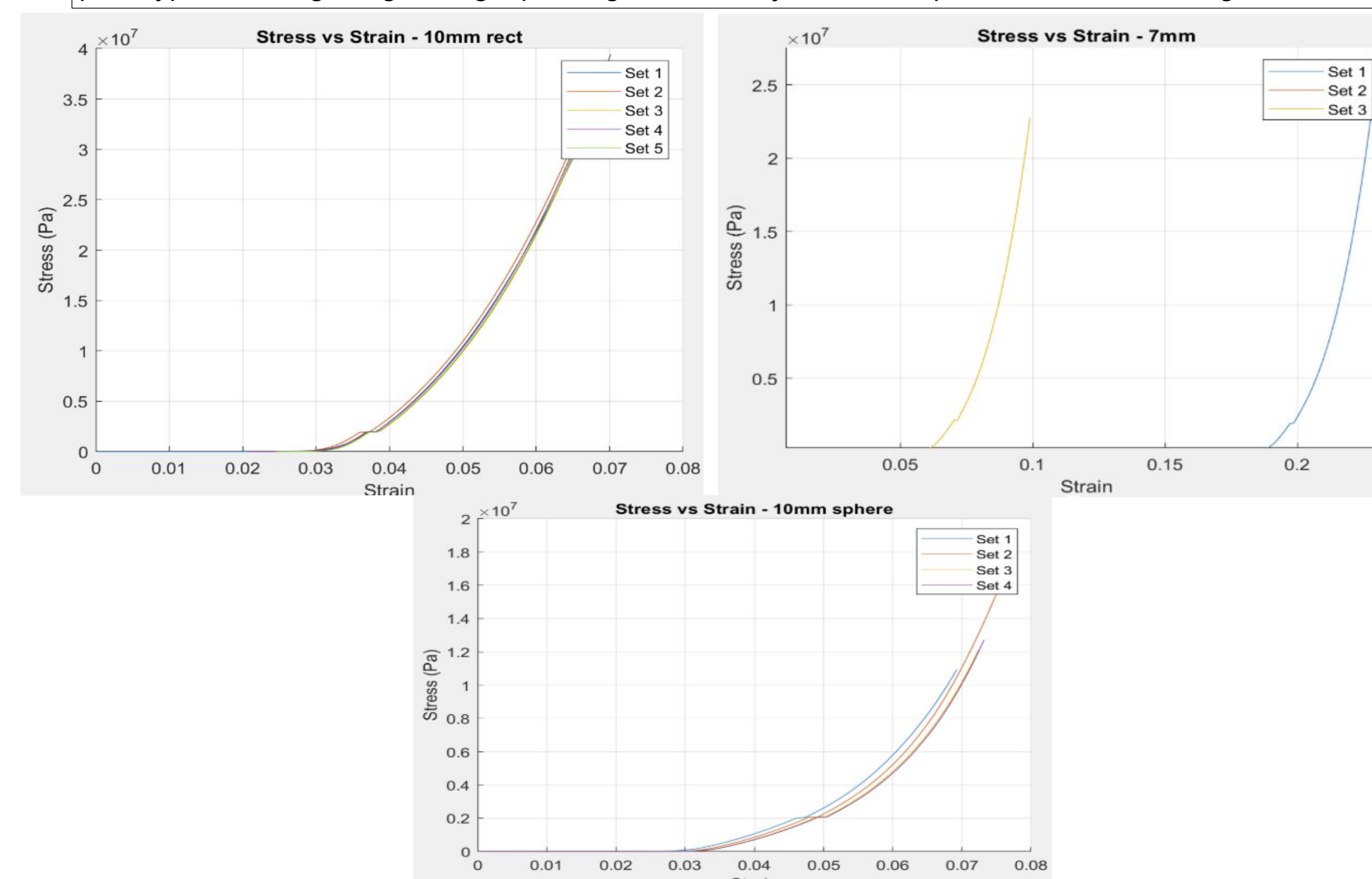
#### Objective:

Engineer an AIS brace that directly addresses the fundamental barriers to compliance by optimizing comfort, discretion, and mechanical performance.

## Device Concept

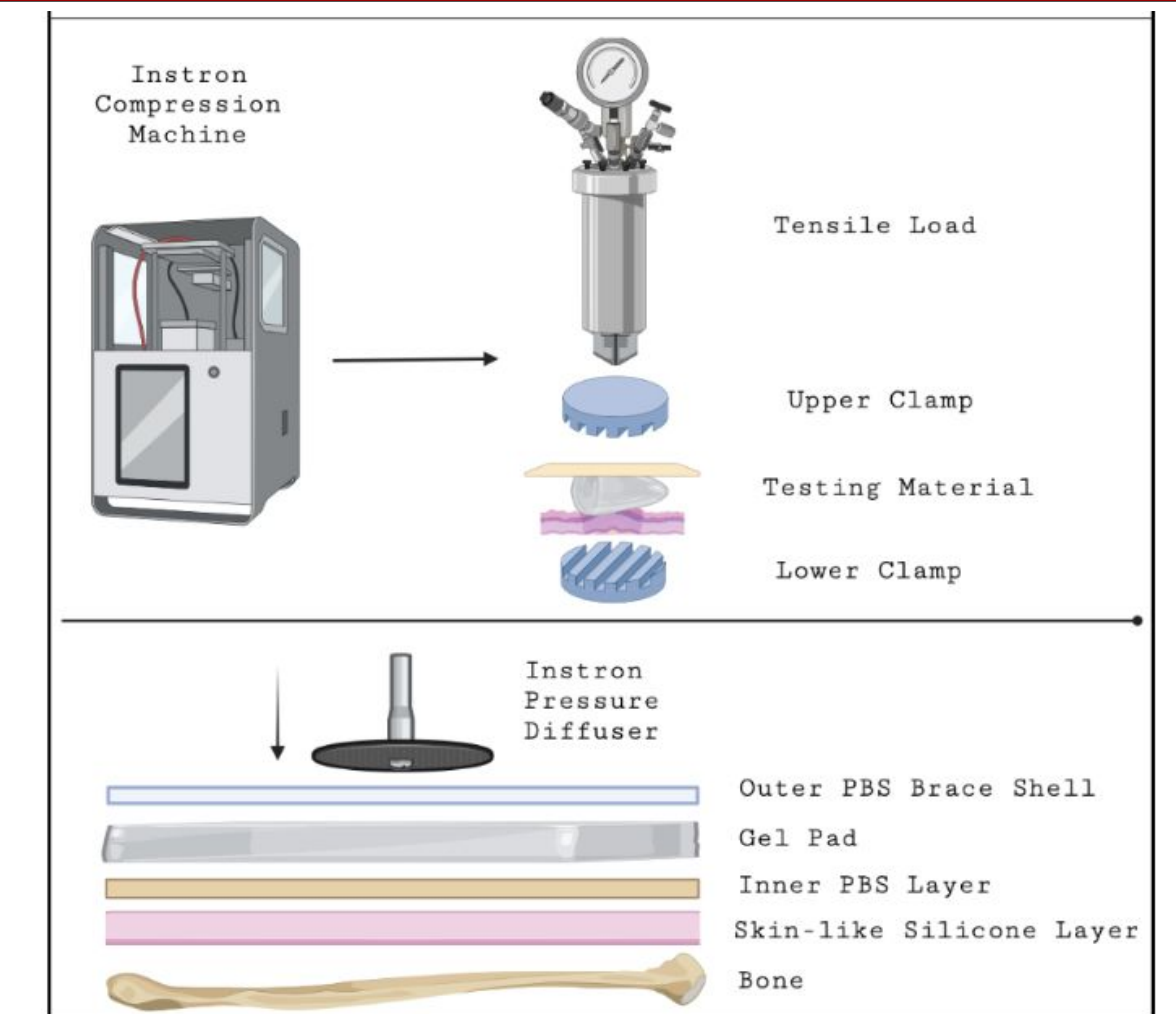


**Figure 1.** CAD models of the downscaled AIS brace shell prototype showing external views of the modular pressure zones and adjustable fastening system. (C) Fabricated downscaled ~50% prototype featuring integrated gel pad regions and adjustable straps for validation testing.



**Figures 2.** The results indicate that 10 mm rectangular gel is preferred as it shows durability, consistency and effectiveness of increasing comfort and applying corrective pressure comparing to the 10 mm spherical and 7 mm rectangular.

## Technical Model/Validation



**Figure 3.** Schematic of the Instron mechanical testing setup used to measure compressive force distribution across the AIS brace materials. The setup includes a tensile load applied via the Instron compression machine, with the testing sample consisting of a layered construct: outer ABS brace shell, gel pad insert, inner ABS layer, skin-like silicone layer, and a simulated bone structure.

GelType	YoungsModulus_kPa	MaxLoad_N	MaxStrain
{'7 mm Rectangular' }	85238	172.59	0.11921
{'10 mm Rectangular' }	7.2727e+05	368.52	0.068962
{'10 mm Spherical' }	1.4132e+05	135.76	0.073205

## Acknowledgement

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