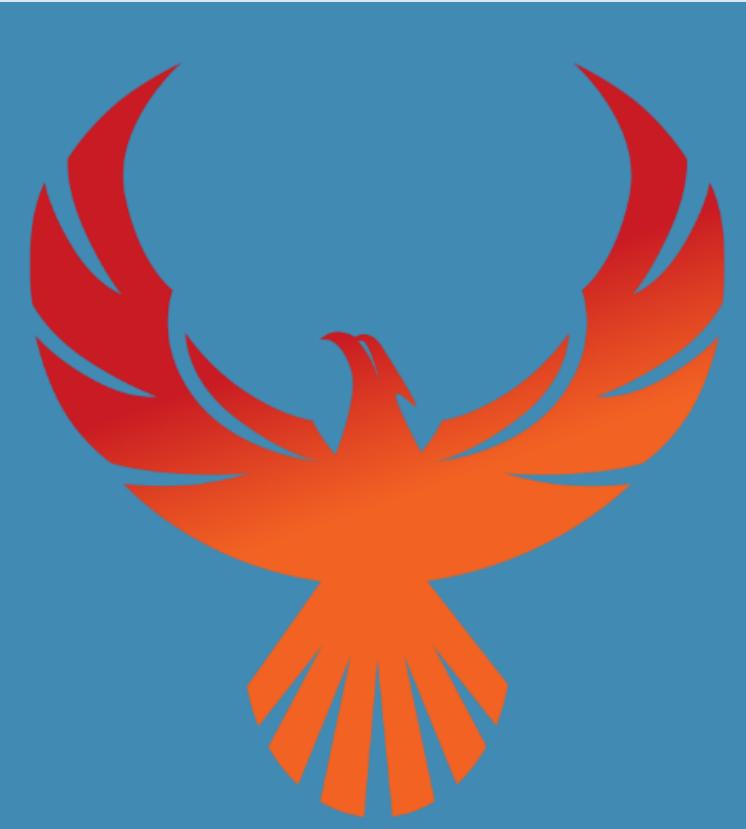


GrowCast: Sustainable, Stronger, and Affordable Patient Specific 3D-Printed Mycelium Casts For Orthopedic Care

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Honors Research

Problem Statement

- Plaster casts have barely changed in 200+ years, yet they're still expensive and break too easily.
- Making and applying them takes too long, wasting time for doctors and patients.
- The materials aren't eco-friendly, and the production process isn't sustainable.
- They're uncomfortable, which makes recovery harder than it needs to be.

Market Research

- We talked to orthopedic specialists to understand the limitations of current casts
- Feedback from patients revealed the casts were too uncomfortable and fragile
- Through online research, we learned the application process was inefficient and the large amounts of material waste.
- We also identified that insurance companies may favor a more durable and cost-effective solution that reduces treatment complications.

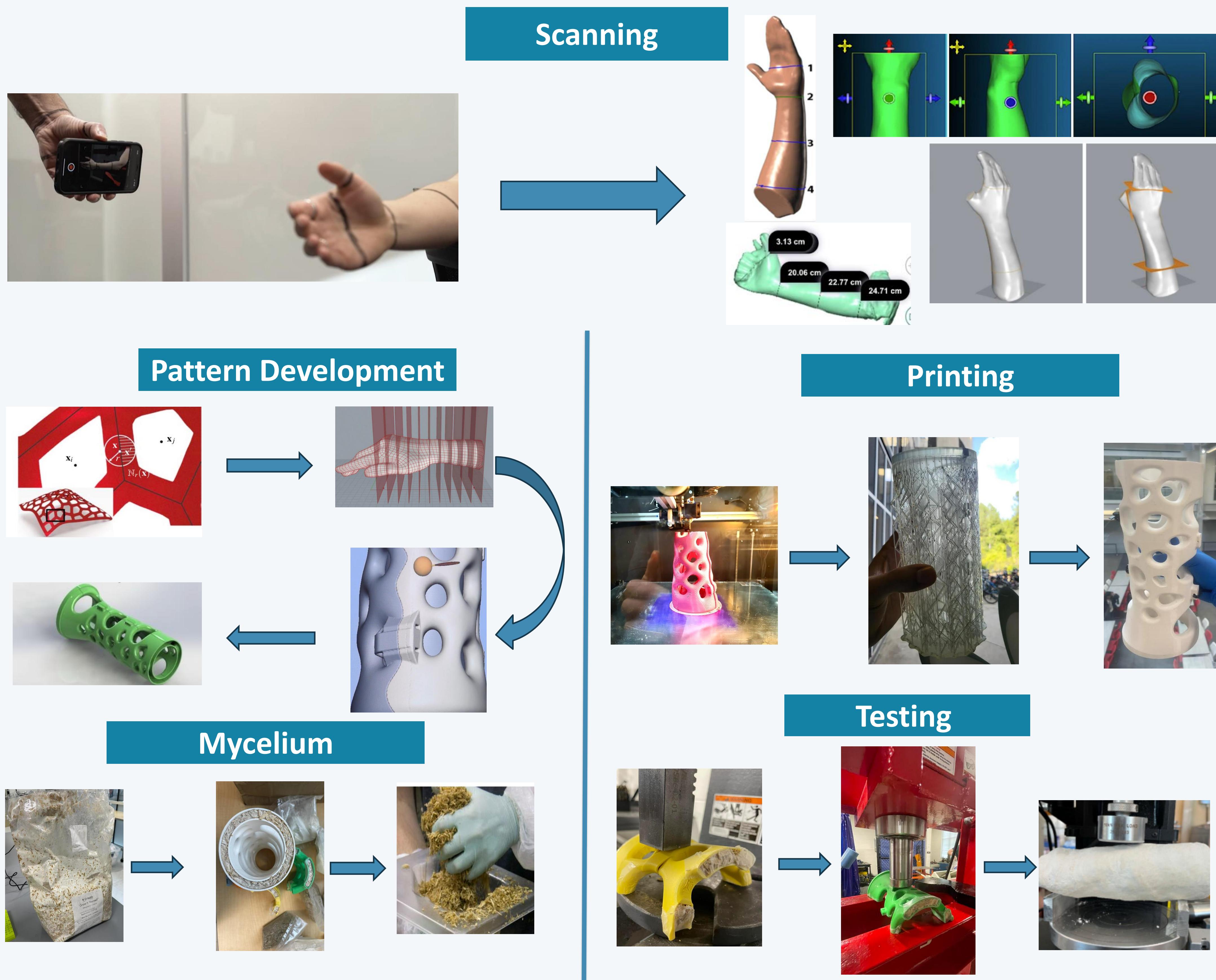
3D Printed Mycelium Casts

- 3D-printed casts with mycelium offer a stronger, lighter, and more breathable alternative.
- Mycelium is biodegradable, making it an eco-friendly alternative.
- 3D printing allows for custom-fitted casts that improve comfort and support.
- Our research explores how this can fix the flaws of traditional casts while helping patients and the planet.

Works Cited

All but one of the photos were taken by us:
<https://blog.adafruit.com/2013/07/01/3d-printed-cast-cortex-jake-evill/>

Manufacturing Process



Data and Results

Variables	3D Cast with Mycelium			Plaster Cast		
	Mean	SEM	P-value	Mean	SEM	P-value
Max Force(N)	525.67 N	17.5	0.034	395.87 N	10.5	0.028
Construct Stiffness(N/mm)	23.3 N/mm	0.7	N/A	18.6 N/mm	0.5	N/A

Table 1: Construct stiffness measures a cast's resistance to bending or compressing underweight. Higher stiffness means better shape retention under load.

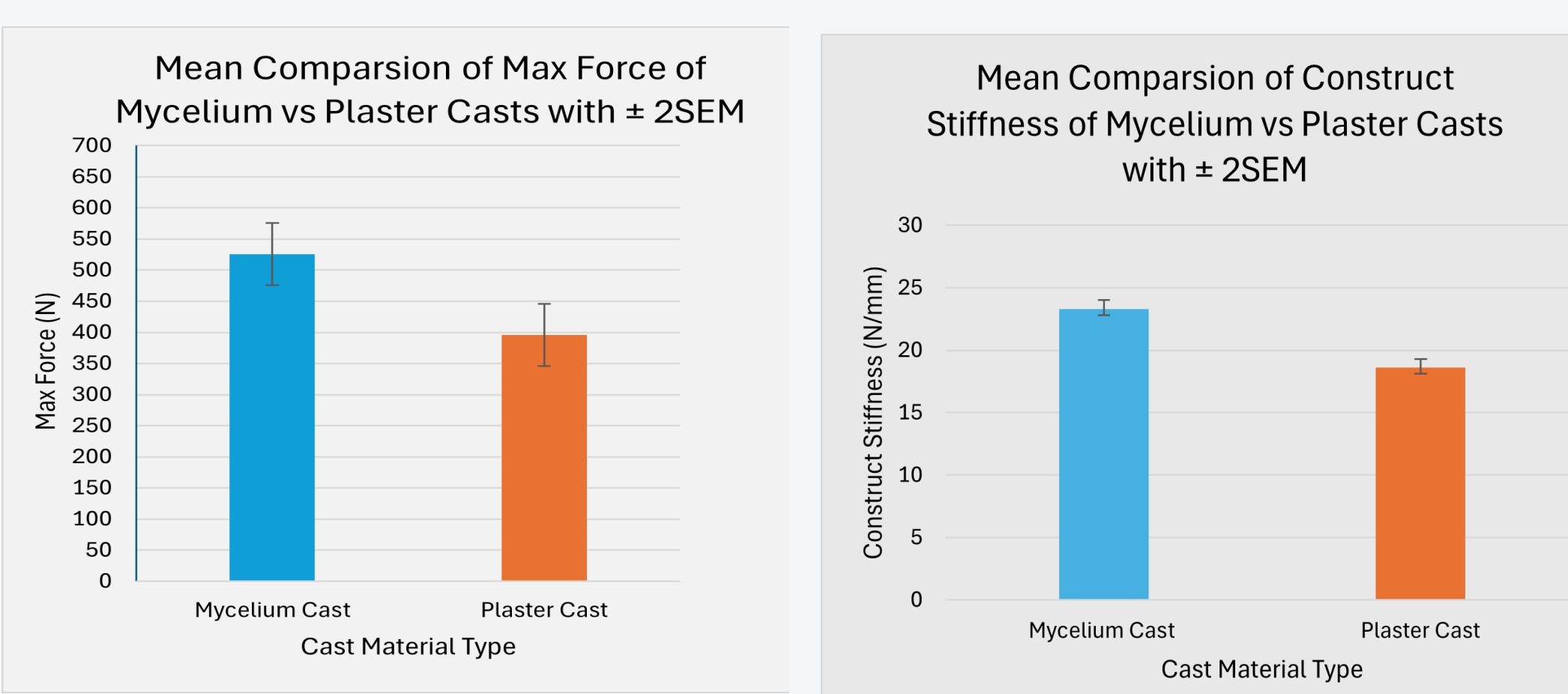
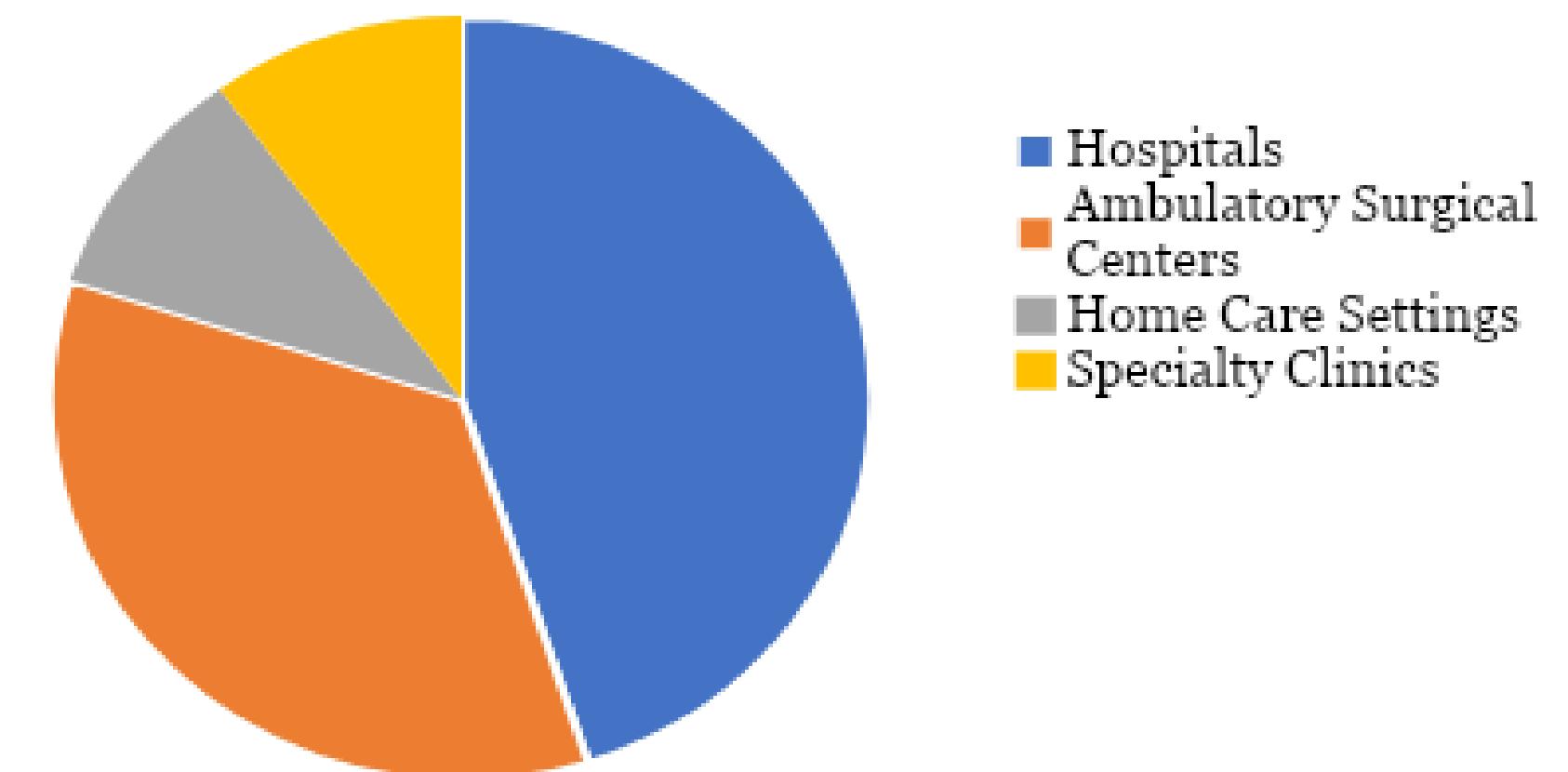


Figure 1: This graph displays the maximum force that mycelium and plaster casts can withstand before breaking, comparing mean values and standard error of the mean (SEM) in newtons

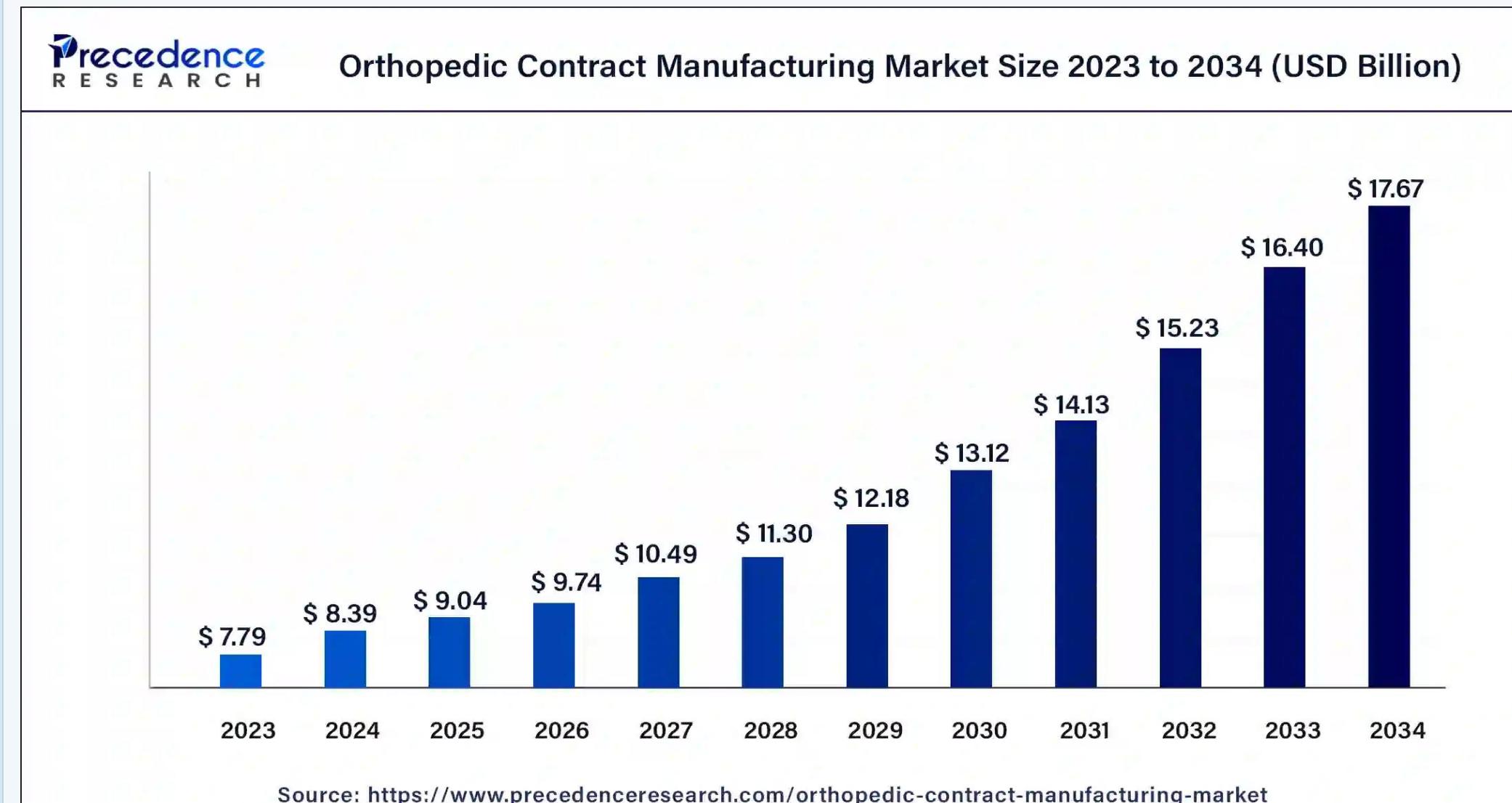
Figure 2: This graph compares the mean construct stiffness of mycelium and plaster casts with 2SEM .

Pricing and Marketing

Global Orthopedics Casts and Splints Market Share (%), By End User, 2021



(DataM Intelligence, <https://www.datamintelligence.com/>, 2024)



Item	Description	Quantity Per Cast	Per Item Cost	Total Cost
Sculpting Bundle	The bundle includes one bag of Grow it Yourself™ Material and one bag of sculpting mix-in.	1/4	\$24	\$6
Heavy Mix	Add this mix to your Grow It Yourself™ material if you want to increase the weight and density of the cast	1/6	\$6	\$1
Reusable Zip-Ties	Re-usable zip ties for closing mechanism.	2	\$0.50	\$0.10
3D Filament	Material that houses mycelium spores. Made with heavy PLA	1/5	\$50	\$10

Total Manufacturing Cost: \$17.10

Future Improvements

- Resin Integration for Enhanced Durability: Implement a resin-printed cast to increase reusability.
- Streamlining Manufacturing for Scalability: Research and develop more efficient manufacturing processes and develop casts for different injuries.