



Developing a modified joint for a prosthetic arm based on joints found on full leg prosthetics

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Background

- Many prosthetic arms cost \$2,000–\$5,000 even for cosmetic models.
- Cosmetic arms often do not replicate natural joint motion.
- Thousands of people, including military veterans, live with a need for prosthetics but can't afford one
- More affordable prosthetics are a necessity for low income households in america



Research Problem

- Prosthetics have gotten too expensive for many Americans
- A easy fix would be more cost efficient materials and a easier production
- However, the prosthetic needs to still replicate the motions of an elbow accurately

Problem Question:

How can we design an affordable elbow joint for a prosthetic arm that still replicates the motions of the elbow?



Engineering goal

Main Objective:

Design a prosthetic elbow joint that replicates natural arm movement.

Movements to replicate:

- Flexion – bending the arm
- Extension – straightening the arm

Goal: Achieve motion similar to a real human elbow joint.



Materials

- 3D-printed elbow joint components
- Wooden dowels (to represent arm bones)
- Glue and duck tape
- Mannequin hand



Procedure

- Design and 3D print the elbow joint model.
- Fit the joint pieces together and glue if necessary.
- Cut two wooden dowels to represent the humerus and radius bones.
- Glue and tape wooden dowels to either side of the joint
- Glue and tape the mannequin hand to the end of the radius dowel



Testing and Data

- Measure the degrees of elbow flexion and extension.
- Compare the results to average human elbow movement.
- Compare data across:
 - Children
 - Adults
 - Seniors
 - Male vs Female averages

This will show how closely the prototype matches real arm motion.



Results and future expectations

- The first test of extension was a success with the joint matching to that of an adult woman
- however the second test of flexion did not match with any of the groups, the easy fix is to sand down the top limiter on the joint to allow for further flexion
- For the future I want to use a polycarbonate filament for the printing and turn the prosthetic into a proper body-movement prosthetic
- If the polycarbonate filament is used a durability test could be performed