Above Elbow Prosthetic (AEP):
An Extension to the LN-4 for Transhumeral Amputees

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Need and Objective

Need

- Around 2.3 million people in developing countries have necessary limb amputations due to events such as:
  - Civil unrest leading to injury
  - Workplace injuries
  - Infection of wounds without proper treatment
  - Birth defects from abnormal fetal development
- Currently, patients with residual limbs that extend below the elbow can currently be fitted with the LN-4 prosthetic hand (provided by the Ellen Meadows Foundation and Rotary Clubs)
- However, for those with amputations above the elbow (transhumeral amputations) or no limb altogether, this prosthetic cannot be utilized (which is pictured in Figure 1).

Figure 1. LN-4 prosthetic hand and assistive shoulder strap.

Objective

We aim to develop an above elbow extension for the LN-4 that matches the price, durability, and application process of the LN-4 in below elbow use.

Prototypes

PROTOTYPE 1

Figure 2. Provided a looks like prototype of the AEP.

PROTOTYPE 2

Figure 3. Illustrates an expanded version of the second prototype featuring joint actuation.

Figure 4. illustrates the upper cuff and novel elbow joint design.

Figure 5. illustrates an exploded view of prototype 3 featuring a ratcheted gear joint.

PROTOTYPE 3

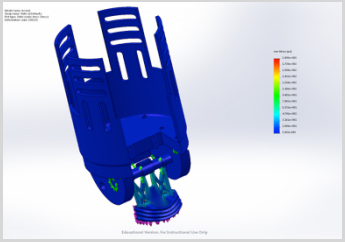

Figure 6. Illustrates maximum stress is locaated in the base of the truss of the ratchet piece at 189.6 psi. PCT has a yield strength between 14100 - 18100 psi. This was simulated under maximum carrying capacity of the LN-4 prosthetic hand at 25 lbs.

Future Directions

Manufacture

- Injection molded PCT 40 percent glass/mineral filled
- Metal casting of magnesium alloy AZ19D
- Highest cost will be initial mold manufacture, which would be offset by production number (likely around ten thousand)
- Cost of each part would be around one hundred dollars

Market

- As a prosthetic aid in low resource areas, this would be funded by a humanitarian minded company or individual (such as the Ellen Meadows Foundation and rotary clubs)
- In the United States, the prosthetic would have to be modified to include a prosthetic hand
- However, this would likely still be marketable in the United States because the overall cost would be lower than many current mechanical and all mechatronic prostheses

FDA / Medicare

- AEP falls under Class I categorization for FDA
- Regulated under external prosthetic code 890.3420
- Product is 510(k) exempt since it has substantial equivalence to devices on the market currently
- Reimbursement within developing countries will be covered by the Ellen Meadows Foundation
- Within the US it is reimbursable by Medicare/Medicaid billed under L codes with justification