The Zip Stitch

Overview
Surgical sutures and staples account for 55% of the global surgical equipment market, which will be valued at 11.28 billion dollars in 2019. Suturing allows for minimal scarring. However, the time required to suture a surgical wound is time consuming, mainly due to the knot tying required for each individual suture. Alternatively, staples allow the surgeon to quickly close a wound, but this results in poor cosmetic outcomes. There is a vast demand for a wound closure technique that has the efficiency of stapling, but the superior outcomes of suturing.

Objectives
The primary objective of this project was to develop a solution for surgical, epidermal wound closure that is time-efficient, ideally by eliminating the need for knot tying. The Zip Stitch is a design that both incorporates the successful cosmetic outcome of sutures, but also reduces the time required for closure by having the ability to secure the suture thread without a knot.

Approach
- The team met with Dr. Josh Winder, a surgical resident at Hershey Medical, to learn about the customer needs in developing a wound closure solution
- Five initial concepts were developed, but the Zip Stitch was chosen through discussion with Dr. Winder and concept scoring
- An extensive patent search was performed to learn about available wound closure devices and ensure that the Zip Stitch did not infringe on any existing patents
- Solidworks models, COMSOL models, and literature research were created and performed to further develop the details of the Zip Stitch design
- Solidworks models were used to 3D the Zip Stitch designs as it evolved and to evaluate its design feasibility
- Multiple prototypes were fabricated through 3D printing and the final prototype was developed using available suture materials and a 3D printed disc component
- The final Zip Stitch design works like a normal suture but uses a melting locking mechanism to secure the stitch in place
- Tensile tests, melting tests, and time tests were performed
- Results demonstrated the feasibility of the Zip Stitch design and its potential for use in wound closure

Outcomes
- Injection molding will be used to produce the polypropylene Zip Stitch
- The Zip Stitch will reduce the time required for wound closure, saving time and money
- The Zip Stitch meets the customer needs
- Further testing will be performed as the Zip Stitch moves toward a 510(k) application