Reinventing the Orthopedic Arm Cast

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Collins / ART494 - Visual Prototyping / Spring 2016

Abstract

Our objective was to produce an arm cast that bridged the gap between traditional and futuristic techniques. We prototyped a traditional plaster cast using hand fabrication methods, then used 3d scanning to capture surface geometry, and proceeded to use 3D modeling systems for adjustments, and 3d printed a final design to present the final concept.

Research Question

In an era where medical technology takes leaps and bounds on a daily basis, we wished to take a look at the future of traditional medical casting, with an emphasis on the arm cast. 1 in 255 people will break their arm at some point in their life, and the process of healing can place a large handicap on their life for the duration. So with new fabrication and 3D tooling procedures becoming more available across the world, how can we improve upon not just the design, but also the methods involved in making an arm cast?

The Process

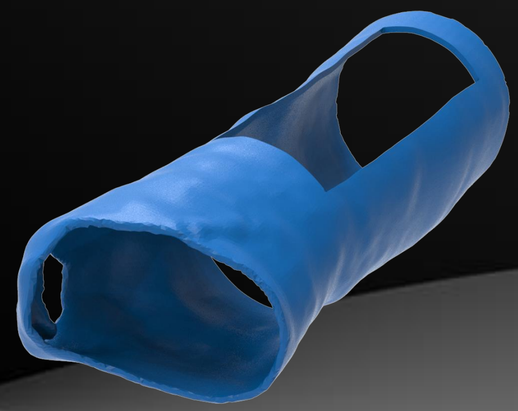
To create our model cast, we began by first creating multiple variations of the traditional plaster wrapping cast which is hailed as the most common type of cast universally in an effort to understand the strengths and traits that make this cast so efficient. Five casts were made with different arms and body types used to get a feel of how traditional casts are applied and where on the arm the casts have their particular weaknesses. We then made use of a 3D scanner to get a digital model of the cast with geometric accuracy. We used this 3D model of the cast to create our eventual final design that provides support and breathability for hygienic purposes and printed the design on a Z Corp powder based 3D printer.

Prior Research and Observations

There are many types and designs for orthopedic arm casts today, and these designs span many ranges of cost, aesthetics, and maneuverability. There are traditional plaster and fiberglass wrap casts, non-traditional bespoke forearm casts, and newer, more futuristic and technologically advanced casting forms such as amphibian skin casts, and the Exogen Bone healing cast and Cortex Evill user customized cast.

Results & Conclusion

The resulting cast that our group fabricated took into thought the lightweight and minimalistic design of the bespoke cast design, while looking at the fabrication methods and materials of the Evill Cortex cast design. We wished to have a cast that would be lightweight and hygienic while still providing reasonable support while the bones mended. The open space on the cast encourages skin exfoliation so as to discourage epidermal infections and allow the user to wash their arm. The supports of the cast are placed in a manner as to not allow pronation or supination in the forearm which are the acts of rotating the wrist/flipping the palm that allows the radius and ulna to move across one another. Although the printed cast model that was created is brittle in nature, we believe that if fabricated using alternative print materials the cast could be worn with light use and provide support while surviving light impacts.



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References

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