Designed Prosthetics

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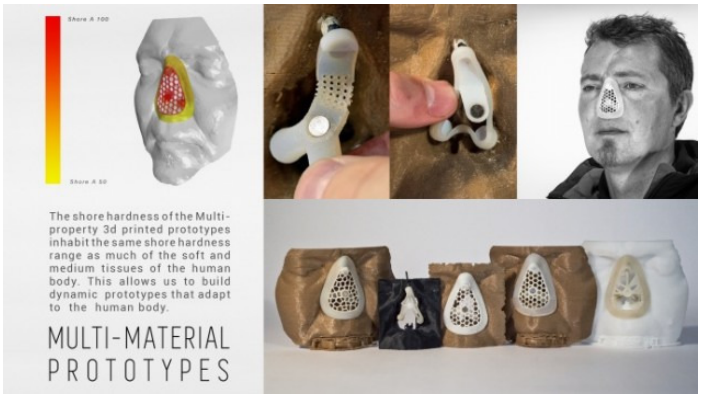

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What It Does

Creating Desirable Facial Prosthetics

The Inspiration

The tradition of the facial prosthesis has been to offer a representation of normality. Using 3D scanning and new methods of 3D printing, design can offer wearers of facial prostheses solutions to long-standing problems. These problems restrict the active lifestyles of the wearer. They fear the dislodging of their nose and exposure of their facial deformities making them anxious in most public situations.

Traditional Prosthesis:
- Costly, ($1000+)
- Ongoing lengthy and expensive consultation to fit each new prosthesis
- Delicate, can tear and degrade quickly and is replaced often
- Easily knocked off or dislodged
- Noticeable despite their realism and quality

New Prosthesis:
- Easily cleaned or replaced
- Low cost ($100) and quick to produce
- Custom fitted and tailored to activity

- Easy to fit and designed to move with facial physiology

How It Works

Our designs have shown we can solve many of the problems of a traditional prosthesis while also being inexpensive and easily replicable. The 3D files are based on a facial scan and three magnet positions so they can be easily adapted to other patients; the three implant configuration is a common retention method.

The prosthetic scaffold or 'Pros-shock' , can provide security for the wearer by acting as a shock absorber. It can decrease the anxiety of wearers in closed spaces like public transport or busy streets. It is also small enough to fit under a traditional prosthesis meaning that it could be included into the workflow of prosthetic technicians with some minor modifications. New retention methods have been suggested by maxillofacial specialists, that could improve the stability and performance of the prosthetic. These will be adopted into our current designs in order to provide the best possible outcome.

This project is on-going and there are many more problems in the area to solve. We are examining the usefulness of the Objet Connex 3, a multi-property 3D printer that can mix material densities and colours to provide a palette of multi-density possibilities. These may allow us a more natural palette of colours that would suit the warmth of human skin tone. Additionally we are looking into some alternative nose shapes for our sporting prosthesis to reduce the profile of the prosthesis in order to make it harder to dislodge and more comfortable to wear.

Collaborators:

Bernard Guy, Ross Stevens - Design Research Supervisor
Michael Williams - Maxillofacial Prosthetist/ Technologist
Wayne Gillingham - Maxillofacial Surgeon
Special Thanks to Julian Goulding

Stages of Development

Our solutions grew from conversations with our participant and assisting prosthetic specialists, alongside the emergence of new technologies.

The first solution was a dynamic scaffold that could sit under our participants prosthesis and provide stability and enhanced retention so it would be more difficult to knock the prosthesis off. This would connect to three implants in the participants skull via magnets and could be used underneath a traditional prosthetic.

The second solution was to develop a two part, non traditional prosthetic for sports or physical activities. This prosthesis could have the same retention mechanism, if the outer prosthetic facade was knocked loose a flat guard would allow airflow and protect the wearers sensitive area. Both parts would be cheap and easy to re-print and the wearer could have a few spare.

We collected our participants facial morphology and implant configuration using the Artec Spider 3d-Scanner. We then used the scan data to model prototypes that conform to the morphology of our participant. Using Rhino 5 and parametric plug-in Grasshopper, we can constantly tweak our models in simple ways to accommodate subtle facial movements.

Early prototypes were quickly modeled using simple FDM 3D-printers to test the fit and position accuracy. Victoria University's Objet Connex 350 multi-property 3D printer allows us to print mixed-density prototypes that have a similar material compliance as the muscle and tissue of the human body. This allows our "Pros-Shock" to be dynamic and forgiving in order to help retain a

prosthesis if it is knocked.

Our collaborative effort consists of a participant, design researchers and Maxillofacial and prosthetic specialists. Regular contact between the researchers, participant and other team members ensures that the design meets both technological standards of the industry and the aesthetic and performance standards of the participant.