

# Reproducible Prosthetic Skin Color

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## Abstract

The goal of our project is to design a faster, systematic method to color prosthetic skin. The process must be able to reproduce prosthetic skin color, be operated by one person, and quantify skin color. Our final design involves printing on partially cured and plasma treated PDMS using an inkjet printer. Test results show that the color adherence withstand isopropyl alcohol. Future work includes further modifications of the printer and optimization of PDMS thickness to resist abrasion.

## Background

- Hand painted prosthetic skin
- Material: silicone, silicone based ink
- Coloring and curing: 3-4 hours
- Cost: \$750-\$1000



Fig. 1. Ear prosthetic produced by Medical Art Prosthetics [1]

## Competition

- Hand painted prosthetic skin by other companies (Otto Bock, Dermatos, Living Skin)
- Potential technique: Rapid prototyping



Fig. 2. Prosthetic by Dermatos [2]

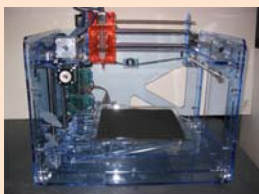


Fig.3. Rapid prototyping machine [3]

## Design Specification

- Pigment: adheres to substrate
- Substrate: Silicone
- Materials: Non-toxic
- Process: operable by one person
- Cost: under \$500

## Final Design

The following series of images depict our process of coloring PDMS.



1) Made 10:1 ratio of PDMS.



2) Vacuum chamber: drew bubbles to surface.



3) Sonication: removed bubbles.



4) Spun 6g PDMS on transparency for 70 sec at 2000 rpm.



5) Partially cured PDMS for 4 min at 90°C.



6) Plasma treated PDMS for 5 min.



7) Printed on sample.



8) Cured printed sample for 5 min at 90°C.



9) Added second layer of PDMS; spun for 70 sec at 2000 rpm. Cured finished sample for 20 min at 120°C.

## Testing and Results

- 4 tests to analyze color adherence
  - Isopropyl alcohol
  - Soap and water
  - Low temperature
  - Sandpaper
- Independent Observer Analysis

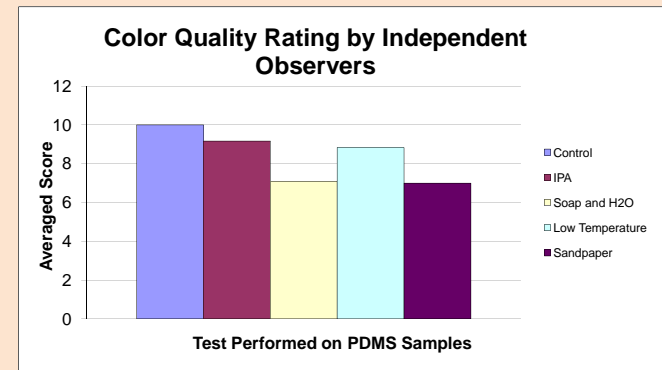


Fig. 4. Summary of color quality as rated by 12 independent observers.

## Future Work

- Modify printer roller to reduce scraping
- Increase intensity of color dispensed
- Optimize thickness of silicone sheet
- Explore different plasma treatment methods
- Apply Photoshop to quantify skin colors
- Upscale for mass production

## References

1. Medical Art Prosthetics. 2007 [www.medicalartprosthetics.com](http://www.medicalartprosthetics.com)
2. Dermatos Prosthetic Skin Company. 2007. <http://www.prostheticskin.org/handprostheses2.htm>
3. "Copying Wrinkles for Better Prosthetic." *NewScientist Blog*. Jan 2007. [www.newscientist.com](http://www.newscientist.com)

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