Cataract Device

Lisle Blackbourn-Leader
Molly Krohn-Communicator
Sean Heyrman-BWIG
Kate Howell-BSAC

Client-Dr. Jon Gunther
Advisor-Dr. Paul Thompson

Overview

- Background
- Problem Statement and Motivation
- Design Specifications
- Design Alternatives
- Design Matrix
- Final Design
- Future Work

Cataracts

- Proteins in the lens deteriorate affecting vision
- Surgery done to replace lens
  - Incisions into cornea
  - Cut hole into capsule
  - Destroy and remove lens
  - Replace with intraocular lens

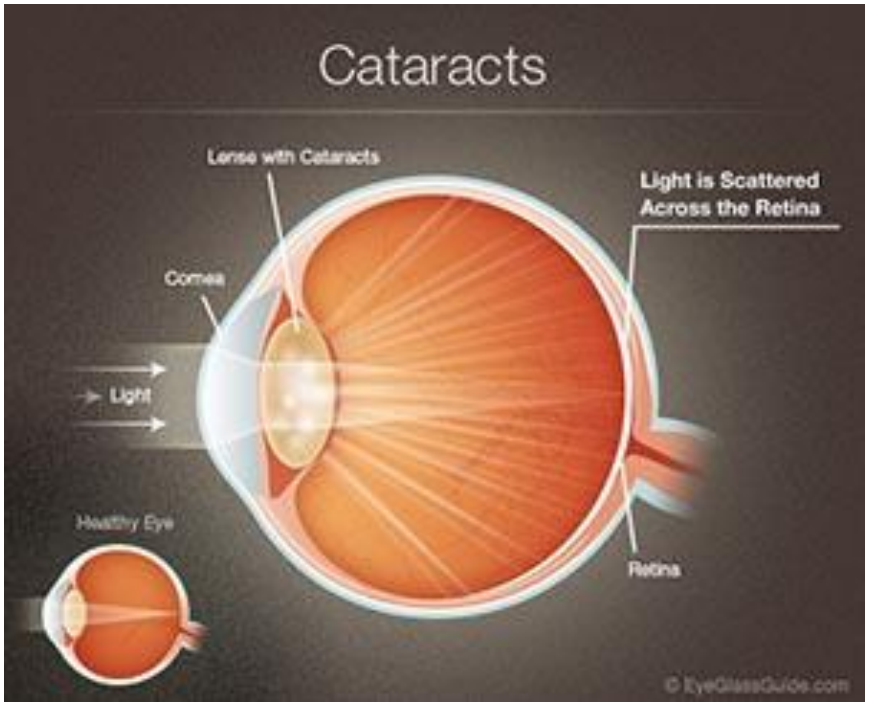
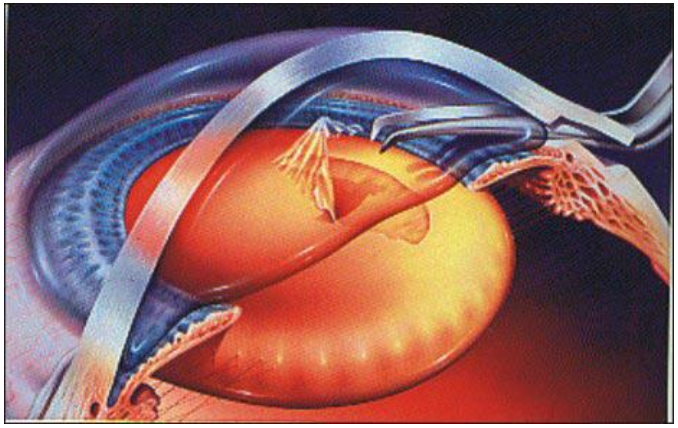


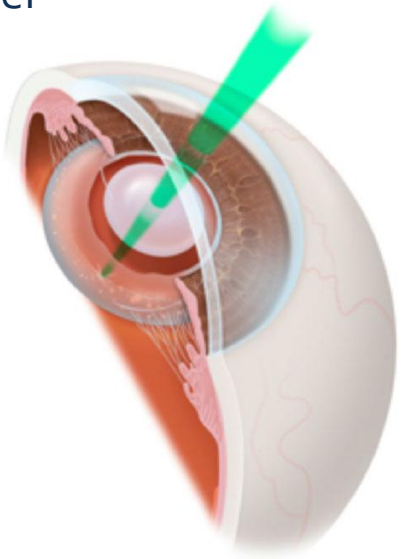
Image from http://www.eyeglassguide.com/content/en/images/cataracts.jpg

Current Methods

Circular Curvilinear Capsulorhexis



Laser



Plasma (Fugo Plasma Cutter)

Images from
(Left) http://www.centralillinoisvision.com/resources/eye_disease_information/
(Middle) http://www.rostimes.com/Pandey_Visco.htm
(Right)http://www.fugoblade.com/Home.html

Problem Statement and Motivation

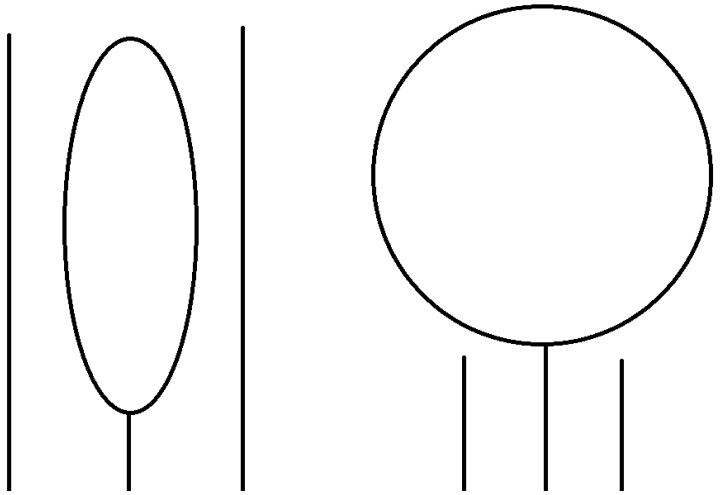
- 1.5 million cataract surgeries each year in US - millions more throughout the world
- A precise mechanical technique that is more cost effective
- Safely enter the human eye through a 2.0 mm incision in the cornea
- Unfold inside the eye into a circular device that creates a 6 mm circular opening in the capsular
- Fold back up and be removed through the previous incision

Design Specifications

- Sterilized before use
- Cut a precise circle (6mm diameter)
- No microtears
- No accidental cuts
- Enter and exit through ~2mm cut
- No change in current protocol of surgery
- $200-$500

Ultrasonic Ring

- Attachment to the ultrasound
- Circular blade
- Unfold into 6mm diameter circle
- Ultrasound vibrations cause the cut



Suction Cut

- Attachment to the Phaco-tool
- Suction setting
- Unfold and refold in eye
- Suction set high enough to cut

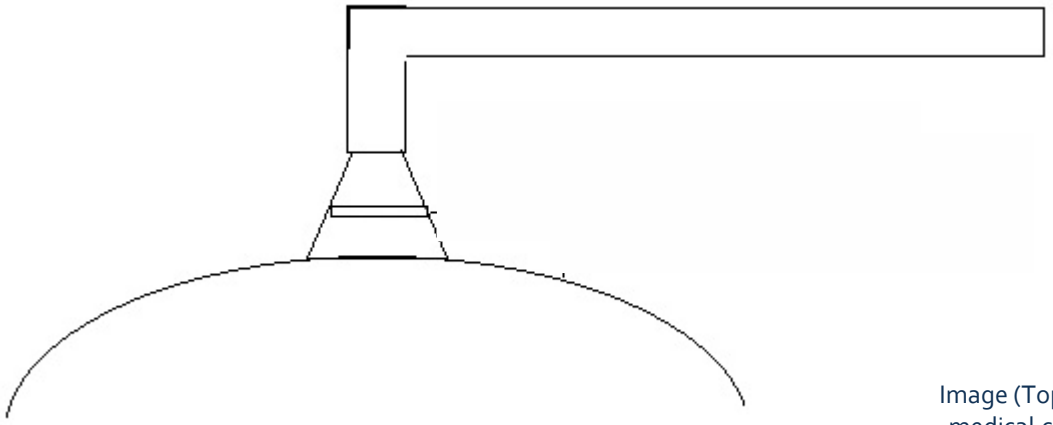
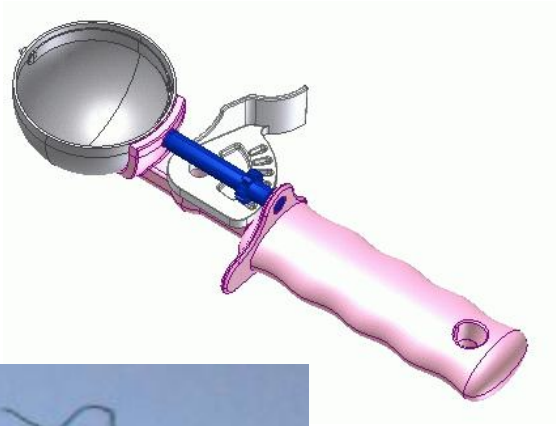
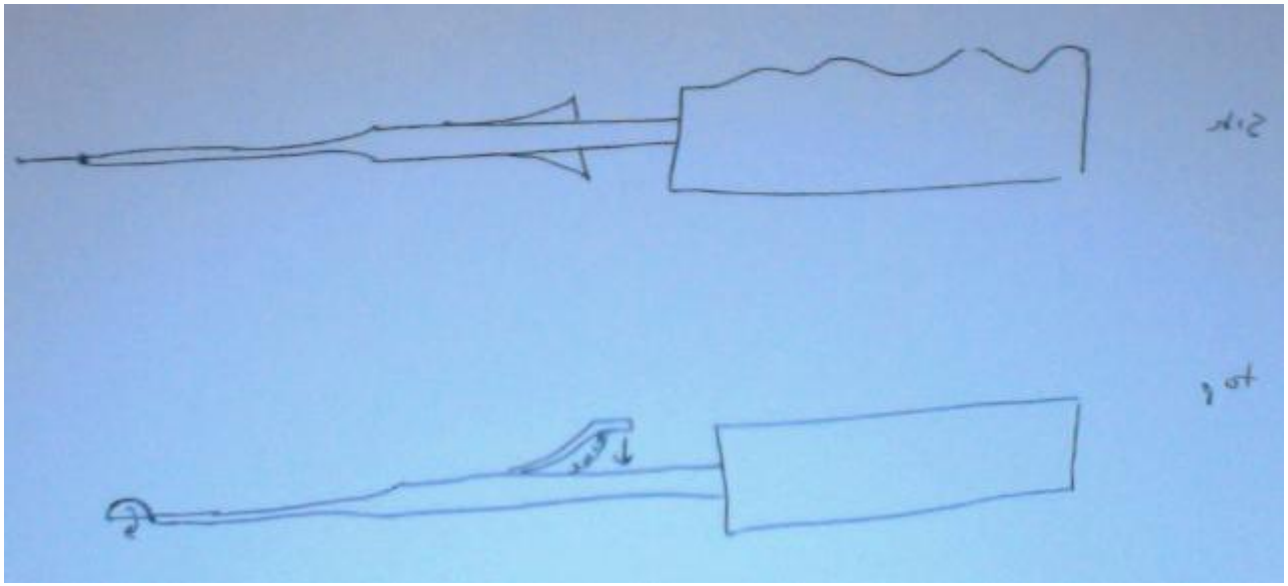


Image (Top) from (http://www.specialty--
--medical.com/KND8888505123.html

Ice Cream Scoop

- Enter eye and "pen push" blade out
- Blade would be a semicircle
- Lever pressed and blade "scoops"



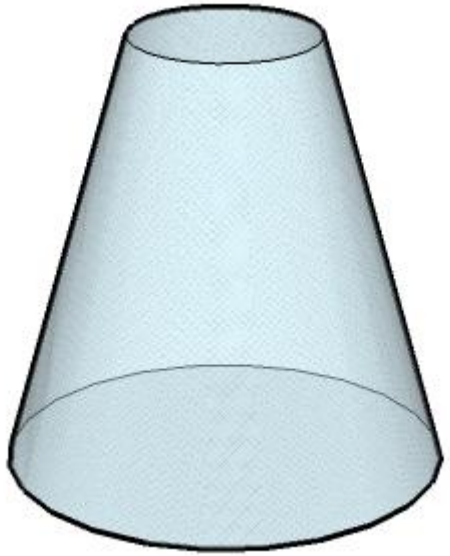


Design Matrix

	Ultrasonic Ring	Suction	Ice Cream Scoop
Precision (x 6)	3	4	2
Safety (x 5)	3.5	2.5	4
Size (x 3)	4	3	2
Fabrication (x 3)	1	3	4
Ease of Use (x 2)	3	4	2
Cost (x 1)	4	4	5
Total (100)	60.5	66.5	59

Final Design

- Attachment to the Phaco-tool
- Utilize the suction setting
- "Party hat" cone design
- Blade on edge of cone



Future Work

- Material research
- Fabrication of prototype
- Testing prototype on cadaver eyes

Thanks to:

- Dr. Jon Gunther
- Dr. Paul Thompson

References

- Dalton, Michelle. "Cataract Surgery Femto Lasers in Cataract Surgery." *Eyeworld.org*. American Society of Refractive and Cataract Surgery, Apr. 2010. Web. Feb. 2012. <http://eyeworld.org/article.php?sid=5413>.
- "Eye Disease Information." *Central Illinois Vision*. Web. 07 Mar. 2012. <http://www.centralillinoisvision.com/resources/eye_disease_information/>.
- *Fugo Plasma Blade*. Medisurg Research & Management Corporation. Web. 27 Feb. 2012. <http://www.fugoblade.com/Home.html>.
- Gunther, Jon. "Client Meeting." Telephone interview. Feb. 2012.
- "Ophthalmic Viscosurgical Devices and Anterior Segment Surgery:." *Rajasthan Ophthalmological Society*. Web. 08 Mar. 2012. <http://www.rostimes.com/Pandey_Visco.htm>.
- Pande, M. "Continuous Curvilinear (circular) Capsulorhexis and Planned Extracapsular Cataract Extraction--are They Compatible?" *British Journal of Ophthalmology* (1993): 153-57. Pub Med. Web. 13 Feb. 2012. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC504460/>.
- Randleman. "Cataract Surgery." *MedicineNet*. Web. 09 Mar. 2012. <http://www.medicinenet.com/cataract_surgery/article.htm>.
- "Your Guide to Eyeglasses & Prescription Glasses." *EyeGlass Guide For Eyeglasses, Glasses, Prescription Eyeglasses*. Web. 7 Mar. 2012. <http://www.eyeglassguide.com/>.

Questions?