EVOLUTION OF CATARACT SURGERY

c. 1200 BC: Earliest records from ancient Egypt of cataract surgery performed by couching

1747 AD: French ophthalmologist Dr. Jacques Daviel performs 1st cataract extraction surgery

1950 AD: Sir Harold Ridley introduces & implants the 1st intraocular lens (PMMA)

1967 AD: Dr. Charles Kelman introduces phacoemulsification for cataract extraction

2015 AD: Where are we at with cataract surgery?

- Cataract surgery is the most commonly performed surgical procedure
- Cataract burden is rapidly increasing in an era of increasing visual demands.
- Over 19 million cataract surgeries performed annually worldwide (3 million in US)
- By 2020, World Health Organization estimates 32 million cataract surgeries will be performed annually

OBJECTIVES: DISCUSS GOALS FOR CATARACT SURGERY IN 2015

Goal # 1: Minimize perioperative & postoperative complications through safer, more efficient surgery

- Advancements in phacoemulsification
  - Smaller incisions = lower infection rates + rapid healing
  - Lower energy, safer fluidic systems
  - Dual pump system for optimal nuclear fragmentation and extraction
  - Less fluid turbulence with intraoperative IOP stability
  - Minimal intraoperative miosis or floppy iris
  - Higher cut rate for safer anterior vitrectomy

- Laser assisted cataract surgery (LACS)
  - How does femtosecond laser work? Ultrafast 10⁻¹⁵ sec pulses minimize energy absorption
    Femtosecond of energy → photodisruption of tissue → transforms tissue into plasma → bubbles separate tissue
  - The procedure
    Preparation: dilation, topical anesthetic, positioning → Successful suction docking of eye → 3-D Imaging of anterior segment: Fourier-domain OCT → Laser ablation → Transfer patient to OR for phacoemulsification & IOL
  - Potential complications: Manufacturers are constantly improving the interface
    - Elevated intraocular pressure: retinal ischemia, optic neuropathy, glaucoma
    - Loss of suction at any point during laser procedure
    - Incomplete laser ablation
Surgical devices

- Iris expansion: Indicated for poor pupil dilation, tamsulosin (Flomax), traumatic or uveitic posterior synechiae
  - Preoperative mydriasis: phenylephrine, tropicamide, cyclopentolate; NSAIDs minimize prostaglandin release
  - Pharmacologic iris expansion: intracameral epinephrine, Omidria
  - Mechanical iris expansion: iris hooks or expansion rings

- Capsular support: Indicated for poor capsular bag support due to zonular weakness or dehiscence. Use capsular tension rings/segments

- Viscoelastic devices: Minimize endothelial cell loss, stabilize anterior chamber and capsular bag
  - 2 types of OVDs: Dispersive vs Cohesive

- Wound closure: Indicated for wound leak at self-sealing incision
  - Suture: less costly, more time consuming
  - Tissue sealant/bioadhesive: $$$$, quick + effective.
  - Resure Hydrogel sealant (mix 2 products for polymerization, then apply within 5 seconds!), other: cyanoacrylate, fibrin adhesive

Goal # 2: Minimize spectacle dependence

- Accurate biometry/aberrometry
  - Pre-operative biometry: calculate IOL selection
  - Axial length: How long is the eye? Keratometry: What is the corneal curvature?
  - Intra-operative wavefront aberrometry: intraoperative aphakic refractive measurements performed prior to IOL placement
  - Less residual refractive error, especially in patients with prior keratorefractive surgery or extreme axial lengths

- Presbyopia correction: Less spectacle use for near/intermediate vision
  - Multifocal diffractive IOL: Alcon ReSTOR, AMO Tecnis ZM900
  - Accommodating IOL: Bausch + Lomb Crystalens
  - Cons: $$$$$$, ↓ contrast sensitivity, ↑ halos/glare
  - Surgical positioning of IOL is critical: role for laser assisted cataract surgery
  - No IOL guarantees 100% spectacle independence. Surgeon must manage patient expectations!

- Corneal astigmatic correction
  - Spectacles or contact lenses
  - Toric Intraocular Lens
  - Incisional surgery: femtosecond laser vs. blade
  - Excimer laser ablation: LASIK or PRK
ARE THESE TECHNOLOGIES WORTH IT?

- Does advanced technology = safer surgery?
  - Ocular viscoelastic devices → less endothelial damage, safer capsular bag IOL placement → safer surgery
  - Iris expansion/agents → stabilization of anterior chamber → safer surgery & less complications
  - Advanced phaco fluidics → safer surgery
  - FLACS: Lower energy → less endothelial damage

- How do we measure the value of these technologies?
  - World Health Organization defines an intervention as cost effective if the total direct costs are <3 times the GDP per capita to avert 1 lost QALY (Quality Adjusted Life Year)
  - “Even with generous assumptions for improvements in visual outcomes and reduction in complications rates over (phaco cataract surgery), (laser cataract surgery) fails to reach the threshold of cost effectiveness in current Australian or US dollars. A reduction in the cost of consumables and overall cost to patient increases the likelihood of (laser cataract surgery) being cost effective.” FEMCAT study group, 2014

- Who pays for the costs of advanced technologies?
  - LACS: Platforms range: $450-550,000/unit
    - Maintenance costs: $40-50,000/year
    - Disposable interface: $300-450/eye
  - Toric/multifocal intraocular lenses: $500-900/lens
  - Most are not covered by insurance at this time, so patients must pay out of pocket
  - This may become more affordable in future…

CONCLUSION: TAKE HOME POINTS

- Cataract surgery has evolved significantly since Ancient Egypt!
- Goal # 1: Recent advancements minimize complications and improve outcomes
  - Rapid visual recovery and healing
  - Improved techniques for complex cases
- Goal # 2: Less spectacle dependence improves quality of life
- Cost effectiveness is yet to be determined…
- Stay tuned for future advances in cataract surgery!!

QUESTIONS??

Thank you for your attention. Questions? Email: psaigal@gmail.com