

# Innovations for Vision: The SERI Experience



Singapore National  
Eye Centre  
SingHealth



SINGAPORE  
EYE  
RESEARCH  
INSTITUTE

**Donald Tan FRCSE FRCSG FRCOphth FAMS**

*Adjunct Professor in Ophthalmology  
Ophthalmology and Visual Sciences Academic Clinical Program, Duke-NUS Medical School  
Senior Consultant, Singapore National Eye Centre  
Senior Scientific Advisor, Singapore Eye Research Institute  
Partner & Senior Consultant, Eye & Cornea Surgeons, Eye & Retina Surgeons  
President, Asia Cornea Society  
President, Association of Eye Banks of Asia*



## My Financial Disclosures

- Santen, Inc. (Grant Support, Consultant)
- Network Medical Products (Patents/Royalty)
- Eye-Lens (Consultant)

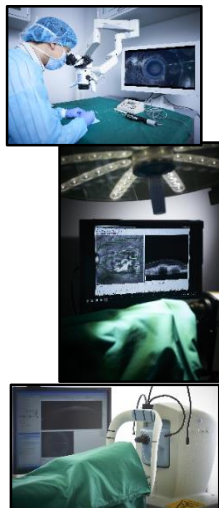
# SERI at Academia: STRONG CORE RESEARCH SUPPORT PLATFORMS

5 Shared Core Platform Technologies  
= Translational Research Focus + Tangible Outcomes  
= Clinical Utility + Economic Value Capture

## Basic Sciences/ Laboratory Platform



## Pre-Clinical Animal Model Platform



## Clinical Research Platform



## Population Health Platform



## Technology Development & Commercialization Platform



# SERI RESEARCH HIGHLIGHTS & ACHIEVEMENTS

**3,405**

scientific papers  
published

**"Best in Asia,  
Second Worldwide"**

Singapore has been  
**ranked second  
globally** and **first in  
Asia Pacific** for both  
the **quantity and  
quality of our eye  
research.**

**195**

Masters, PhD,  
post-doctoral  
students

**123**

patents filed

**16**

research  
groups

**Focusing on  
the Figures**

**1,603**

studies on all  
aspects of eye  
research

**S\$309**

million in  
competitive  
grant funding  
secured

**506**

national and  
international  
awards

**53**

principal  
investigators

**40**

PhD  
scientists

**18**

clinician  
scientists

**196**

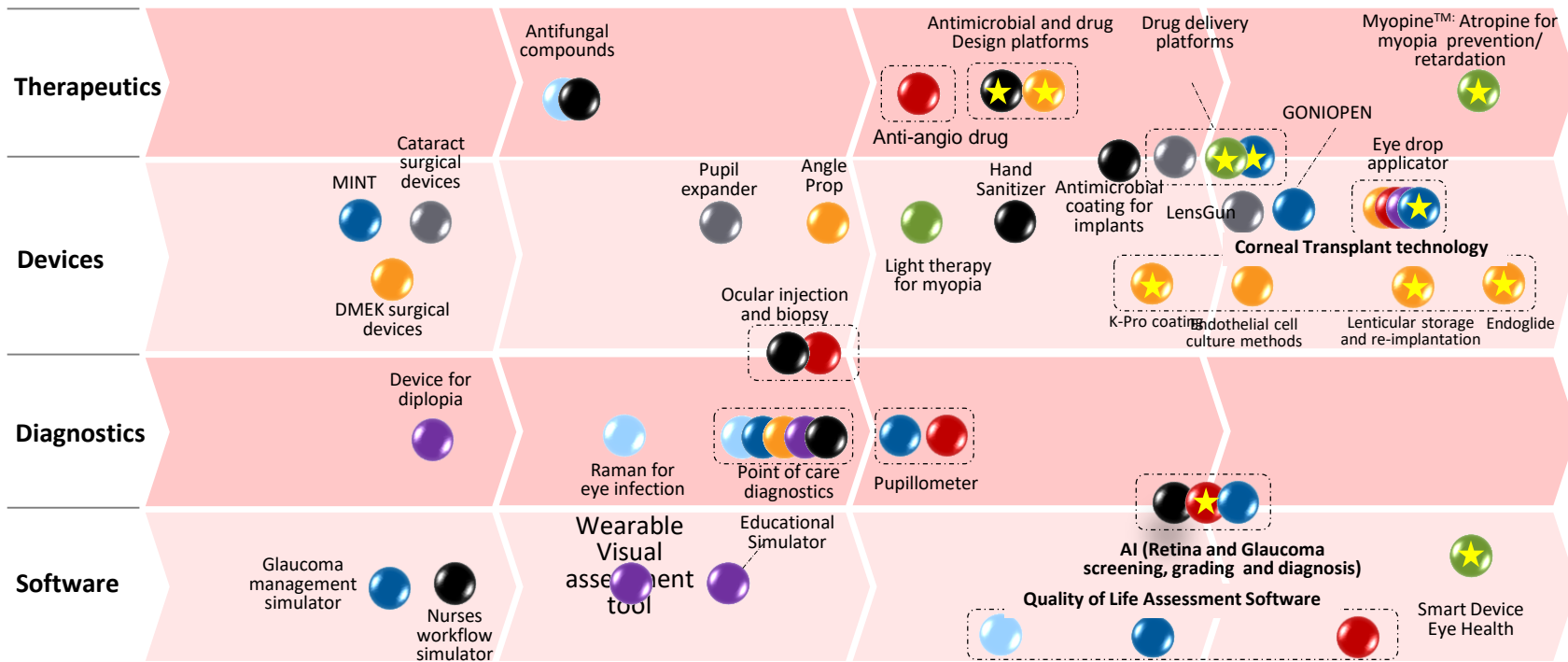
researchers,  
doctors, clinicians,  
clinician scientists  
and  
administrators

**17**

MD-PhDs

*Data as of end Dec 2018*

# RESEARCH TRANSLATED INTO SERI TECHNOLOGIES (AS OF 14 MAY 2018)



**Stage of Development**

**Concept (Discovery)**

**Proof of Concept (Early pre-clinical)**

**Prototype (Late pre-clinical)**

**Industry Validation (Human Trials)**

- Cornea
- Cataract
- Glaucoma
- Myopia
- Retina
- Ocular surface
- Other Eye conditions
- Beyond Eye
- Group of technologies
- Commercial success



# FINAL CURTAIN CALL: TCR **TRIOS** & **EYESITE**: A DECADE OF GREAT SCIENCE & ACHIEVEMENTS



## Comments by SAB:

- The overall achievements of the EyeSITe TCR Flagship Programme at SERI were impressive and impactful.
- By any of the NMRC-aligned objective measures, this TCR EyeSITe Flagship Programme has been an outstanding success.



# LIST OF ACHIEVEMENTS (TRIOS & EYESITE)

Performance Indicators			TRIOS	EYESITE
Capability indicators	Training R&D manpower for industry*	PhD students trained	6	5
		Post-doctoral	18	15
	Developing long term R&D capability	Joint programs/projects with local /international universities	20	19
		Clinical trials	8	
		Patents filed	24	
		Patents granted	2	
		Patents commercialized	2	
		Number of competitive research grants received	25	
		Papers published in international journals*	142	
		Presentations at international conferences	201	135
		Number of projects with industry	19	11
		Industry funding (\$ in mil)	\$3.01M	\$8.44M
		Industry support received in-kind (\$ in mil)	\$1.1M	\$14.56M

Performance Indicators			TRIOS	EYESITE
Industry Relevance Indicators	R&D collaboration	Revenue from royalties and licensing agreements	\$0.114M	\$0.816M
		Spin-off companies registered	2	0
	Outcomes	New products or processes commercialized	2	3

# SANTEN-SERI OPEN INNOVATION CENTER (SONIC)



## New research lab gets \$37m to study major eye diseases

Yuen Sin

The Singapore Eye Research Institute (Seri) yesterday announced a five-year collaboration with Japanese company Santen Pharmaceutical to conduct re-search on major eye diseases in Asia.

A total of \$37 million will be invested in a joint Sant-en-Seri lab at the Academia building near the Singa-pore General Hospital over the next five years.

The research will be partially funded by the Government's Research Innovation Enterprise 2020 Plan, which was unveiled last year to encourage innovation and technology adoption in companies.

The lab will open by the second half of this year. Lo-cal and Japanese research scientists will work togeth-er. The lab will initially be staffed by four researchers.

Seri executive director Aung Tin said an industry partnership will speed up the process of translating scientific research into products that help patients, such as new medication or surgical devices.

"It can be very daunting for scientists to form a start-up and raise funds on their own... but through this partnership, we will know immediately if (a dis-covery) is feasible as a project," said Professor Aung.

Speaking at the opening of the 32nd Asia Pacific Academy of Ophthalmology Congress at the Suntec Convention Centre yesterday, where the partnership was announced, Health Minister Gan Kim Yong said vision-related disorders are the second-highest cause of disability burden here, and the fourth-highest cause of disease burden, according to a 2010 study.

"Looking ahead, the disease burden of ophthalmo-logic conditions is expected to increase as the popu-lation ages, particularly in Singapore," said Mr Gan, adding that research and innovation can play a role in providing better care for patients.

**TRIOS and  
EyeSITE TCRs**

**S\$37 Million Santen-SERI Open Innovation Center (SONIC), jointly funded by A\*STAR IAF-ICP grant and Santen**

**Santen-SERI FIM RCT on a new formulation of a patented Atropine gel for myopia – completion by year end**

# COMMERCIALIZATION SUCCESS – FIRST SPIN OFF FROM TCR- TRIOS

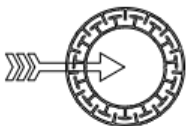


- **Spin off:** SinSa Laboratories Inc. (Founded in 2014)
- **Product:** New Class of bioengineered antibiotics aimed at global Superbugs.
- **Located in Karolinska Incubator – preparing for IPO in Stockholm**

**Prof Roger Beuerman**



## OUR TECHNOLOGY



### 01 / EFFECTIVE

SinSa Labs' Spearhead Antibiotics are a new class of bioengineered antibiotics aimed at treating the world's Superbugs. Their novel mechanism of action makes them faster-acting and more effective than current generation antibiotics



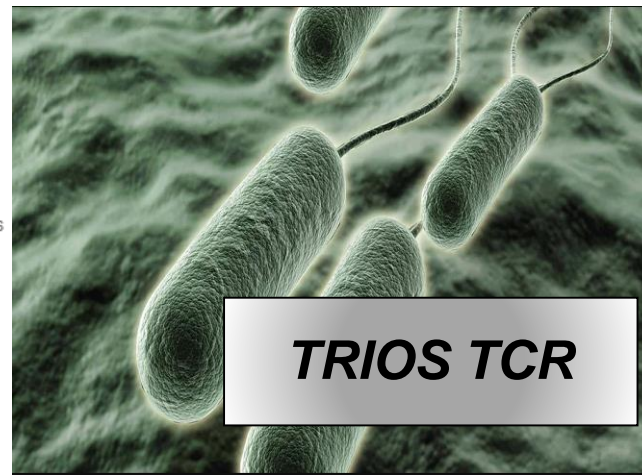
### 02 / SAFE

Spearhead Antibiotics are designed to exploit the differences between human and bacterial cell membranes. They show promising activity against drug-resistant bacteria and--critically--extremely low toxicity in mammalian cells



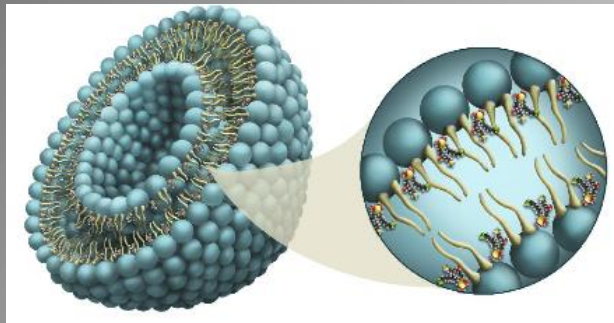
### 03 / UNAVOIDABLE

Bacteria develop resistance to antibiotics in common ways. Spearhead Antibiotics are designed to target pathogens in different ways so that they can't employ these most effective methods of resistance





**PEREGRINE**  
Ophthalmic



- **Spin off:** Peregrine Ophthalmic Pte. Ltd. (Founded in 2013 and based in Singapore)
- **Product:** Liposomal latanoprost. The first nanomedicine product in ophthalmology. For the treatment of glaucoma.
- **License:** Joint patent from SERI and NTU



**Assoc Prof Tina Wong**

## 4 | TOP STORIES

### Global pharma firms interested in local startup's new glaucoma treatment

By Claire Huang  
huangjy@sph.com.sg  
@ClaireHuangBT

Singapore

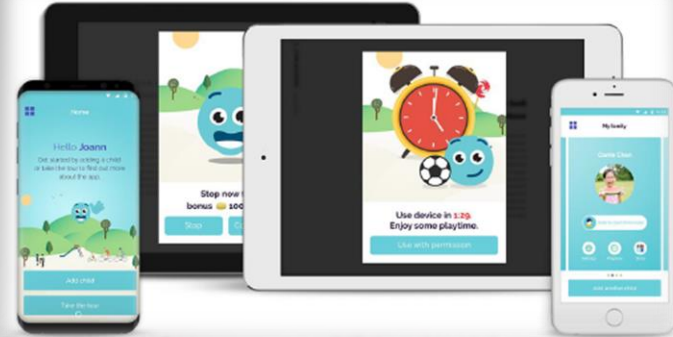
"FIRST you have my interest, now you have my attention."  
And that is what local biotech startup Peregrine Ophthalmic managed to do, in the words of associate professor Tina Wong, who was describing how a new glaucoma drug delivery solution developed by her 15-month-old startup has attracted inquiries from the world's top five pharmaceutical companies.

# PLANO: OUR THIRD SPIN-OFF & FIRST START-UP ARISING FROM THE SNEC-SERI INCUBATOR

# plano

Managing smart device use and myopia in children worldwide

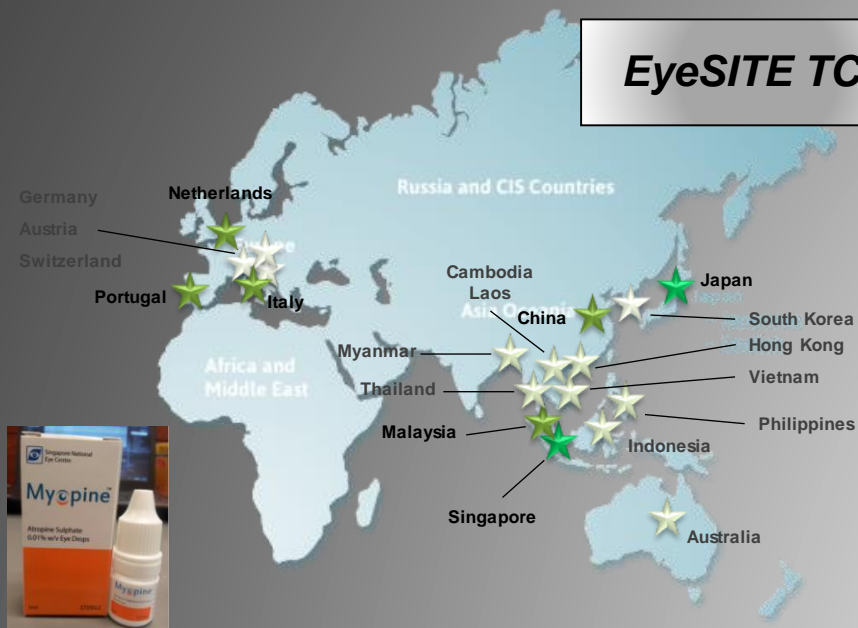
- Establishment of **third spin off** for SERI-SNEC, the **first start-up company** from **the SERI-SNEC Ophthalmic Technologies Incubator**
- plano is an innovative parental management application that aims to encourage healthy and safe smart device (phone and tablet) use in children worldwide
- Investment: Raised **SGD 1 million** from Singapore based angle investor
- Award winning app: **1 gold and 2 silver medals** at Mob-Ex Awards 2018; **1 gold medal** at the MARKies Awards 2018;
- Partnership: partner widely with local industry players and agencies incl. **HPB, WRS, M1**, etc



# COMMERCIALIZATION SUCCESS – LICENSING DEALS FOR MYOPINE™ & SELENA

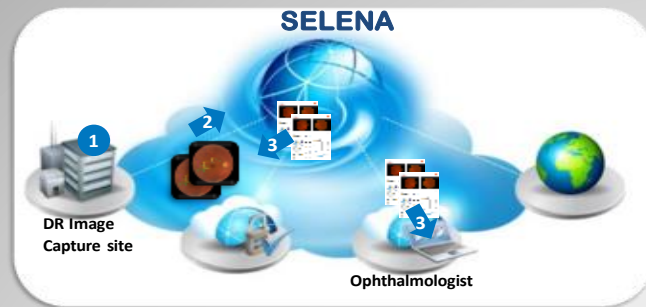
## Myopine™: Low Dose Atropine for Retardation of Pediatric Myopia Development

*EyeSITE TCR*



- ★ Licensed & in use (named patient basis)
- ★ Licensed (in the process of getting regulatory approval)
- ★ License negotiation in progress

## SELENA: AI-based Retinal Image Analysis for DR Screening



### Commercialization and real clinical use

- Side-by-side clinical validation
- Integration into SiDRP, the Singapore national DR screening program
- **Licensed to Imaging MNC, covering major markets globally (20 countries);**
- Received further commercial interests from multiple private entities for licensing SELENA and SELENA “plus”;
- Exploring opportunities for spinning off a start up company

## ...CLINICAL IMPACT OF OUR TRANSLATIONAL RESEARCH

**FDA-approved: Tan Endoglide**

### Comparison of Donor Insertion Techniques for Descemet Stripping Automated Endothelial Keratoplasty

Jialin S. Hsiao, MD, PhD (Editor), Tsing Wang, PhD, MD (Editor), Shih-Hsin Wu, MD, PhD, FRCPC (Editor), Peter V. Berman, PhD (Editor), and, MD, PhD (Editor)

**Objective:** To evaluate the influence of individual and group factors of driver status on behavior in the event of a slipping automated stabilized suspension.

Descemet Stripping Automated Endothelial Keratoplasty  
With a Donor Insertion Device: Clinical Results and  
Complications in 100 Eyes

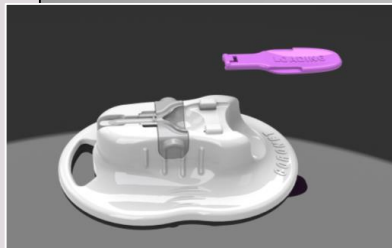
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[illegible][illegible]

PLATE 2 with the use of the British

Other key publications:

3. Khor WB, Mehta JS, Tan DT. Decosmet stripping automated endothelial keratoplasty with a graft insertion device: surgical technique and early clinical results. *Am J Ophthalmol*. 2011 Feb;151(2):325-32.e6.
4. Khor WB, Tan KY, Mehta JS, Tan DT. Decosmet stripping automated endothelial keratoplasty in complex eyes: results with a donor insertion device. *Cornea*. 2013 Aug;32(8):1063-8.
5. Ang M, Saroj J, Htoon KM, Kiew S, Mehta JS, Tan D. Comparison of a donor insertion device to slides used in Decosmet stripping endothelial keratoplasty: 3-year outcomes. *Am J Ophthalmol*. 2014 Jul;157(1):163-169.e5.
6. Ang AY, Lu YC, Tan DT, Mehta JS. Decosmet stripping automated endothelial keratoplasty with the EndoRise Ultrathin graft insertion device. *Expert Rev Med Devices*. 2014 Nov;10(11):573-8.



**Impact:**

The Tan Endoglide, a patent-protected device developed at SNEC and SERI, is used to deliver donor corneal tissues to treat endothelial dysfunction. Glide insertion

# Corneal Blindness

the largest number of these aortic valve transplants in Asia and is one of the leading transplant centres worldwide, largely due to the EndoGlide device.



**25** | In Pursuit  
of Research  
Excellence  
**1990 – 2015**

## Research Papers with Clinical Impact

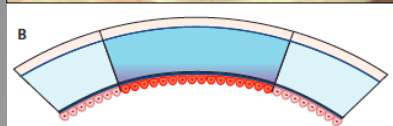
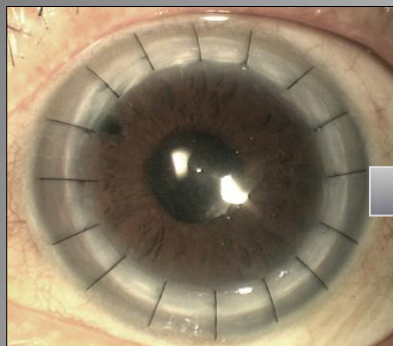
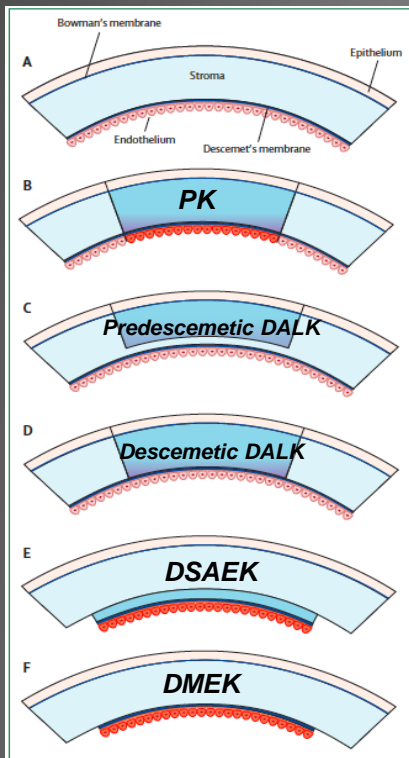


# Myopia



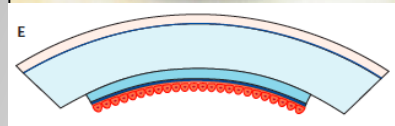
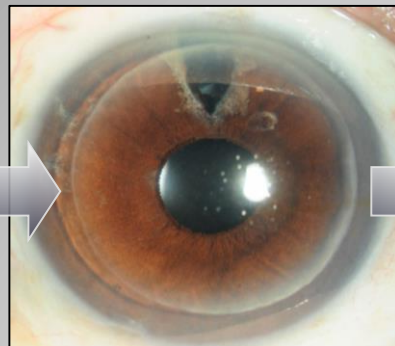


# A Paradigm Shift in Corneal Transplantation - away from Penetrating Keratoplasty



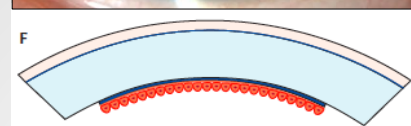
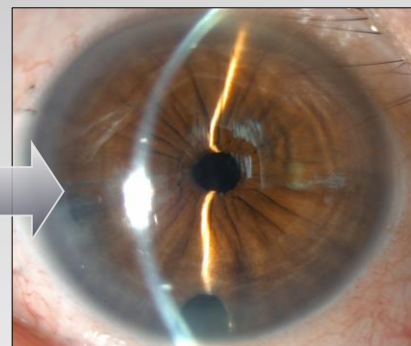
**Penetrating Keratoplasty (PK)**

- Conventional full-thickness corneal replacement
- Sutures needed
- Rejection rate - 15%



**Descemet's Stripping Automated Endothelial Keratoplasty (DSAEK)**

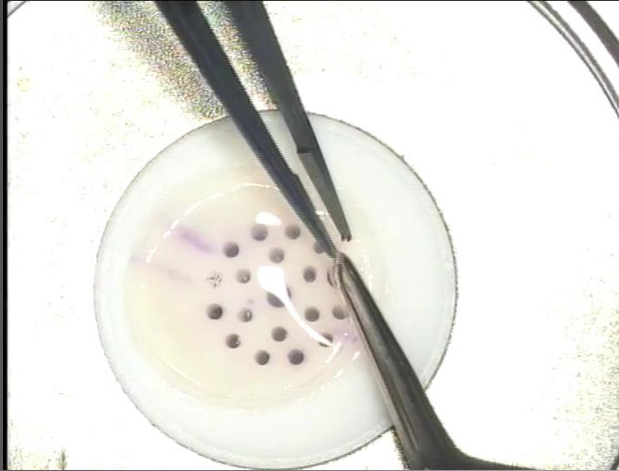
- Sutureless, keyhole op
- Better visual quality
- Lower rejection rate - 8%



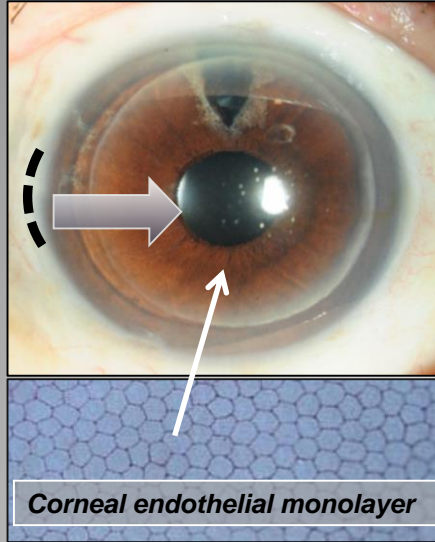
**Descemet's Membrane Endothelial Keratoplasty (DMEK)**

- Best visual quality
- Lowest rejection rate - 2%

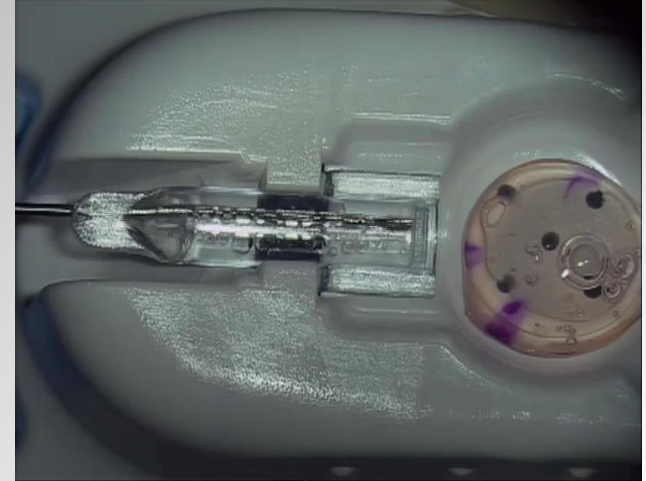
# ***The “ship in the bottle” challenge in DSAEK: Inserting a 9mm donor through a 4mm incision***



***Original Taco Folding technique –  
damaging to tissue (West)***



***Corneal endothelial monolayer***



***Tan EndoGlide Device – more surgical  
control, less tissue damage***

## **Key Surgical Challenge:**

*How can we get a thin (150um) donor tissue, which measures 8-9mm in diameter, through a 4mm opening, without touching or damaging the inner endothelial cell monolayer?*

# Performing DSAEK using the Tan EndoGlide (Network Medical, UK)

- Designed at SERI, **specifically for Asian eyes**, made in the UK by Network Medical Products
- Launched in 2009, FDA Class 1 device, CE Mark
- Designed for Asian eyes – more challenging, smaller eyes
- EndoGlide Ultrathin (UT) launched in 2012 – replaced the EndoGlide Classic version



**Tan EndoGlide  
Ultrathin  
Version #2:**

Replaces first  
version

Used for normal  
thickness and  
ultrathin  
DSAEK

## A Prospective Study Comparing EndoGlide and Busin Glide Insertion Techniques in Descemet Stripping Endothelial Keratoplasty

VINOD GANGWANI, ADANNA OBI, AND EMMA J. HOLLICK

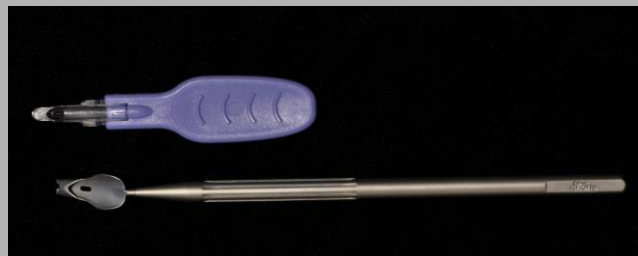
- EndoGlide (n=22) versus Busin Glide (n=30)
- 6 month endothelial cell loss:

EndoGlide: 17.7%\*

Busin Glide: 39.8%\* (p=0.001)

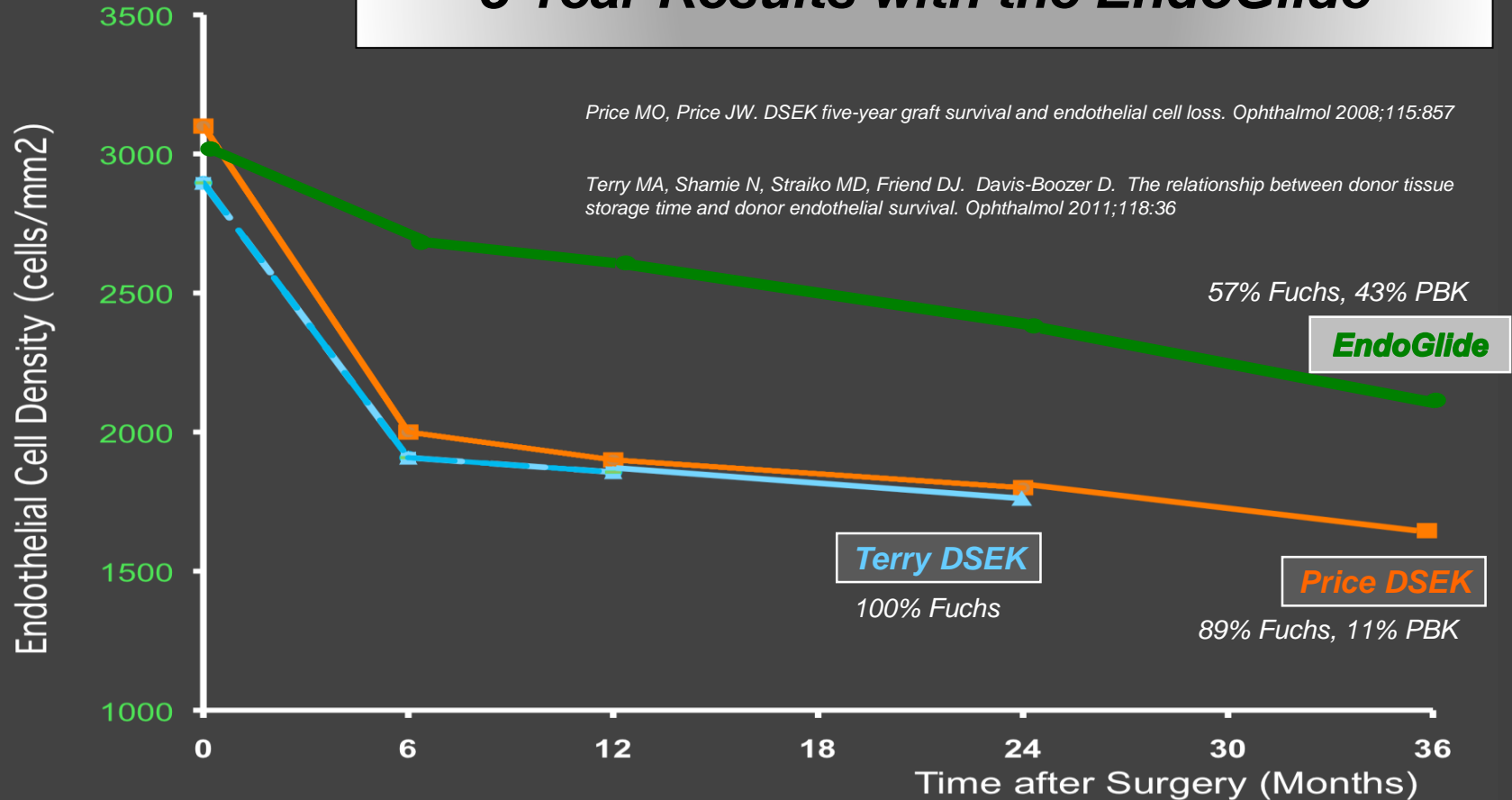
**“The EndoGlide is a better option for donor  
insertion in DSEK than the Busin Glide,  
because it results in higher endothelial cell  
counts at 6 mths after surgery”**

\* after 8% correction for organ culture



Gangwani, Obi, Hollick. Am J Ophthalmol 2012;153:38-43.

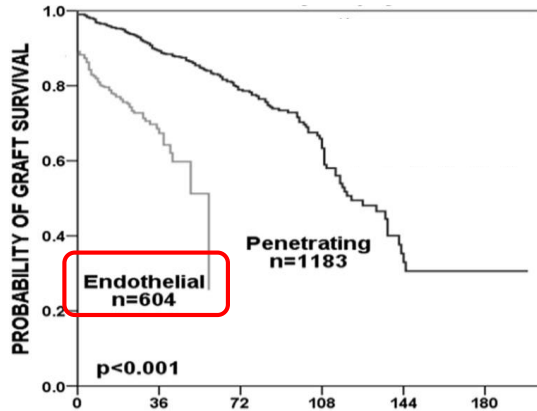
# 3 Year Results with the EndoGlide





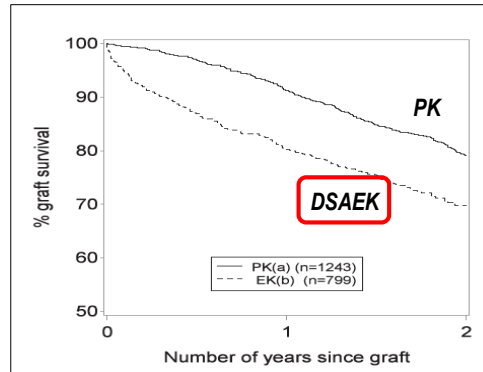
# DSAEK results from Corneal Transplant Registry Data: Australia, UK, Singapore

## Australian Corneal Graft Registry (ACGR)



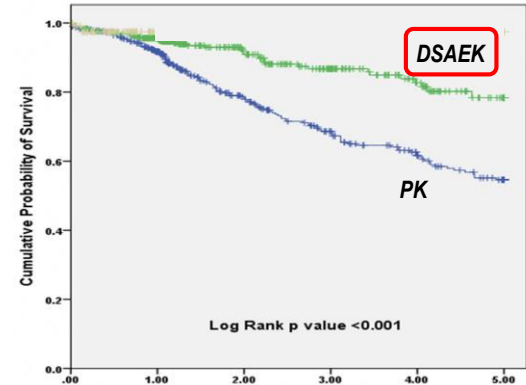
Coster DJ, Lowe MT, Keane MC, Williams KA; for the Australian Corneal Graft Registry Contributors. A comparison of lamellar and penetrating keratoplasty outcomes. A registry study. *Ophthalmology* 2014;121:979-87

## UK Corneal Graft Registry (UK OTAG)



Greenrod EB, Jones MNA, Kaye SB, Larkin DFP. Centre and surgeon effect on outcomes of endothelial keratoplasty versus penetrating keratoplasty in the UK. *Am J Ophthalmol* 2014;158:957-066

## Singapore Corneal Graft Registry (SCGR)

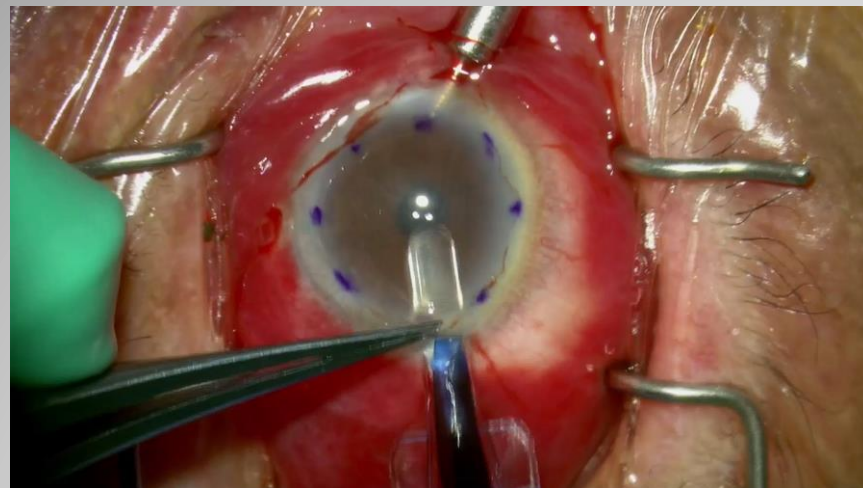
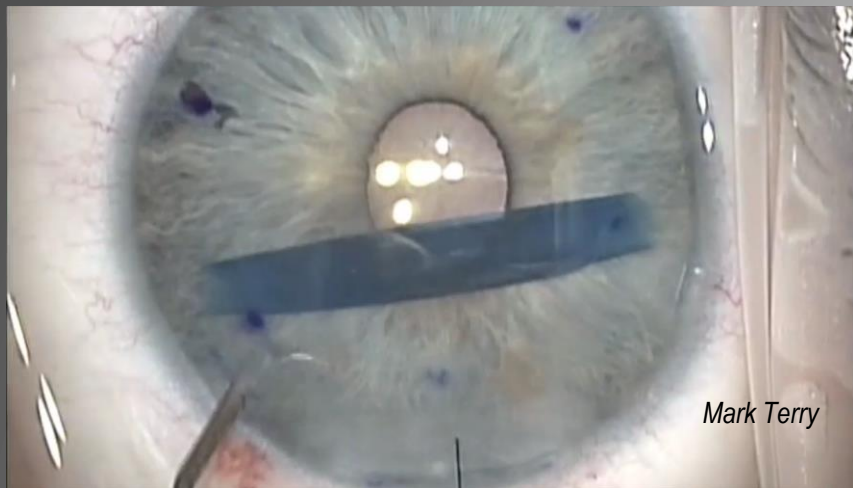


Ang M, Mehta JS, Lim F, Bose S, Htoon HM, Tan D. Endothelial cell loss and graft survival after DSAEK and PK. *Ophthalmology* 2012;119:2239-44

UK and Australian Graft Registry results showed that DSAEK, mostly with the standard taco technique, had poorer graft survival compared to conventional penetrating keratoplasty, citing learning curve issues

Our DSAEK results using the Tan EndoGlide shows significant improved graft survival compared to conventional PK

# ***The New Surgical Challenge of DMEK - Adapting and Innovating***



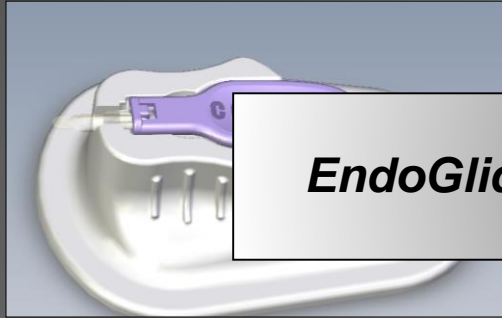
## ***Major surgical challenges in DMEK:***

- *DMEK is better than DSAEK – less rejection (8% v 2%), better visual quality*
- *Original Western surgical technique – very basic – injecting the donor and trying to unscroll it in an uncontrolled manner*
- *Major surgical challenge – less than 6% of corneal surgeons have converted to DMEK*

***The SNEC/SERI approach: Adapting the EndoGlide DSAEK technique to perform DMEK surgery...***

# ***Evolution of the EndoGlide Series – a Decade of Innovation***

**1. EndoGlide Classic**  
(Conventional DSAEK -150um)



**2. EndoGlide Ultrathin**  
(Ultrathin DSAEK <100um)



**3. DMEK EndoGlide (E-DMEK)**






***EndoGlides are now been used in 31 countries***




*Coiling Saddle for thinner tissue*



*Thinnest tissue (DM),  
smallest wound size*

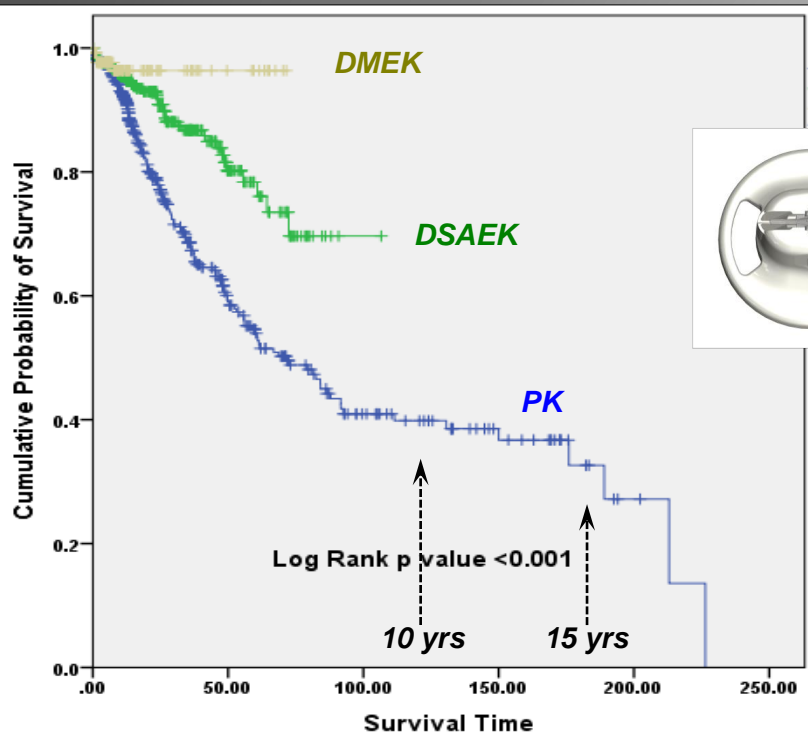


A close-up photograph of a human eye wearing a contact lens. The lens is clear and covers the cornea. The iris is visible through the lens, and the pupil is centered. The surrounding eye tissue and eyelashes are also visible.





# SCTS Graft Survival between PK, DSAEK and DMEK: *Less is MORE...*



- 944 corneal grafts: 405 PKs  
423 DSAEKs  
116 DMEKs

	Year 1	Year 2	Year 3	Year 4	Year 5
PK	91.7%	78.1%	68.6%	61.6%	54.6%
DSEK	95.6%	90.9%	86.8%	82.7%	78.4%
DMEK	97.3%	97.3%	97.3%	97.3%	97.3%

# TACKLING THE MYOPIA EPIDEMIC WITH ATROPINE

## Atropine for the Treatment of Childhood Myopia

Wei-Han Chua, FRCSEd(Ophth), FAMS,<sup>1,2</sup> Vignan Balakrishnan, FRCSEd(Ophth),<sup>1</sup> Yong-Huak Chan, PhD,<sup>2</sup> Louis Tong, FRCSEd(Ophth),<sup>1</sup> Yvonne Ling, FRCSEd(Ophth), FRCOphth,<sup>1</sup> Boon-Long Quah, FRCSEd(Ophth), MMed(Ophth),<sup>1</sup> Donald Tan, FRCSEd(Ophth), FRCOphth,<sup>1,2,3</sup>

**Purpose:** To evaluate the efficacy and safety of topical atropine, a nonselective muscarinic antagonist, in slowing the progression of myopia and ocular growth.

**Design:** Parallel-group, placebo-controlled, randomized, double-masked study.

**Participants:** Four hundred children aged 6–10 years with myopia of −1.00 to −6.00 diopters (D) and astigmatism of ≤1.50 D.

**Intervention:** Participants were assigned to receive either 0.01%, 0.05%, or 0.1% atropine eye drops once nightly for 2 years. Only 1 eye of each child was treated.

**Main Outcome Measures:** The main effect was measured by cycloplegic refraction at baseline and at 2 years. Secondary outcomes included axial length, retinal thickness, and visual acuity.

**Results:** At 2 years, the mean change in spherical equivalent refraction was significantly lower in the atropine-treated group compared with the placebo group (p < 0.001).

**Conclusions:** Topical atropine effectively slows the progression of myopia in children.

**Financial Disclosure(s):** The authors have nothing to disclose.

**Key Words:** myopia, atropine, childhood, treatment, progression.

## Atropine for the Treatment of Childhood Myopia: Effect on Myopia Progression after Cessation of Atropine

Louis Tong, FRCSEd(Ophth), FAMS,<sup>1,2</sup> Xiao Ling Huang, BSc (Hons),<sup>2</sup> Angelina L. T. Koh, BHSce,<sup>2</sup> Xiaoxue Zhang, MSc,<sup>2</sup> Donald T. H. Tan, FRCSEd(Ophth), FRCOphth,<sup>1,2,3</sup> Wei-Han Chua, FRCSEd(Ophth), FAMS,<sup>1,2</sup>

**Purpose:** The aim of this study was to assess the effect on myopia progression after cessation of topical atropine treatment.

**Design:** Parallel-group, placebo-controlled, randomized, double-masked study.

**Participants:** Four hundred children aged 6 to 12 years with refractive error of spherical equivalent −1.00 to −6.00 diopters (D) and astigmatism of ≤1.50 D.

**Intervention:** No intervention was provided after cessation of atropine treatment, which consisted of either 0.01%, 0.05%, or 0.1% atropine eye drops.

**Main Outcome Measures:** The main effect was measured by cycloplegic refraction at baseline and at 2 years after cessation of atropine treatment.

**Results:** After cessation of atropine treatment, the mean change in spherical equivalent refraction was significantly lower in the atropine-treated group compared with the placebo group (p < 0.001).

**Conclusions:** The effect of atropine treatment on myopia progression is maintained after cessation of treatment.

**Financial Disclosure(s):** The authors have nothing to disclose.

**Key Words:** myopia, atropine, childhood, treatment, progression, cessation.

Myopia has high prevalence in Singapore, which has been increasing rapidly in the last few decades.

re: taking a public



severity, it can 80% of the myopic within a significant Although low



## Atropine for the Treatment of Childhood Myopia: Changes after Stopping Atropine 0.01%, 0.1% and 0.5%

ONALD TAN

%, 0.1%, and 0.01% 75%, 70%, and 60%, months compared to changes in spherical −0.30 ± 0.60; −0.38 (D), respectively, placebo-treated group.

**Before: Singapore has the highest rates of myopia in the world, with 80% of young adults having myopia. Children with untreated myopia worsens by 100 degrees/year. Those with severe myopia at risk of retinal degeneration and blindness**

11 Wong  
D T H Tan  
V Balakrishnan  
A S M Lim

in the late 1970s, to 43% in the mid 1990s, and 83% in 2015. This is accompanied by a proportion with myopia

**Treatment with atropine eyedrops slows myopia progression by 60% → clinically used in myopic children**



# SERI's 5 RCTs on Myopia Progression – over 20 yrs of Clinic Trials

**SERI has conducted 5 RCTs on myopia progression in children, spanning 2 decades, and involving 1,897 children:**

1. **RGP contact lens RCT** – 428 children, 2 year study: no effect
2. **PAL spectacles RCT** – 314 children, 3 year study: no effect
3. **Pirenzepine gel RCT** – 353 children, 1 year study: a positive effect: but some side-effects – Novartis dropped the drug
4. **ATOM1 RCT** – 1% atropine v placebo, 400 children over 3 years
5. **ATOM2 RCT** – 0.5% vs 0.1% vs 0.01% atropine, 400 children over 5 years

## A Randomized Trial of Rigid Gas Permeable Contact Lenses to Reduce Progression of Children's Myopia

JOANNE KATZ, ScD, OLIVER D. SCHEIN, MD, MPH, BRIAN LEVY, OD, MSc,  
TOM CRUICULLO, BS, SEANG-MEI SAW, MBBS, MPH, PhD,  
UMA RAJAN, MBBS, MPH, FAMS, TAT-KEONG CHAN, FRCOph, FRCS,  
CHONG YEW KHOO, FRCSoph, FRACS, FAMS, AND SEK-JIN CHEW, FRCOph, FAMS, PhD

*Am J Ophthalmol* July 2003;82:90

## Major Articles

Two-year multicenter, randomized, double-masked, placebo-controlled, parallel safety and efficacy study of 2% pirenzepine ophthalmic gel in children with myopia

R. Michael Siakowski, MD,<sup>a</sup> Susan A. Cotter, OD, MS,<sup>b</sup> R.S. Crockett, PhD,<sup>c</sup>  
Joseph M. Miller, MD, MPH,<sup>d</sup> Gary D. Novack, PhD,<sup>e</sup> and Karla Zadnik, OD, PhD,<sup>f</sup>  
for the U.S. Pirenzepine Study Group<sup>g</sup>

*Ophthalmology* 2005;112:84-91

## Atropine for the Treatment of Childhood Myopia

Wei-Han Chua, FRCS(Ed)(Ophth), FAMS,<sup>1,2</sup> Vivian Balakrishnan, FRCS(Ed), FRCOphth,<sup>1</sup>  
Yong-Hook Chan, PhD,<sup>3</sup> Louis Tang, FRCS(Ed), FRCOphth,<sup>1</sup> Yoonmei Ling, FRCS(Ed), FRCOphth,<sup>1</sup>  
Boon-Leng Quah, FRCS(Ed), MMed(Ophth),<sup>1</sup> Donald Tan, FRCS(Ed), FRCOphth,<sup>1,2,3</sup>

*Ophthalmology* 2006;113:2285–2291

## Atropine for the Treatment of Childhood Myopia: Safety and Efficacy of 0.5%, 0.1%, and 0.01% Doses (Atropine for the Treatment of Myopia 2)

Audrey Chia, FRANZCO,<sup>1,2</sup> Wei-Han Chua, FRCS(Ed)(Ophth), FAMS,<sup>1,2</sup> Yin-Bun Cheung, PhD,<sup>1,4</sup>  
Wan-Ling Wong, MBBS,<sup>2</sup> Amelia Lingham, SRN,<sup>4</sup> Alan Fong, FRCS(Ed)(Ophth),<sup>1,2</sup>  
Donald Tan, FRCS, FRCOphth,<sup>1,2,3</sup>

*Ophthalmology* 2012;119:347–354

# ATOM1

Ophthalmology 2006;113:2285–2291

## Atropine for the Treatment of Childhood Myopia

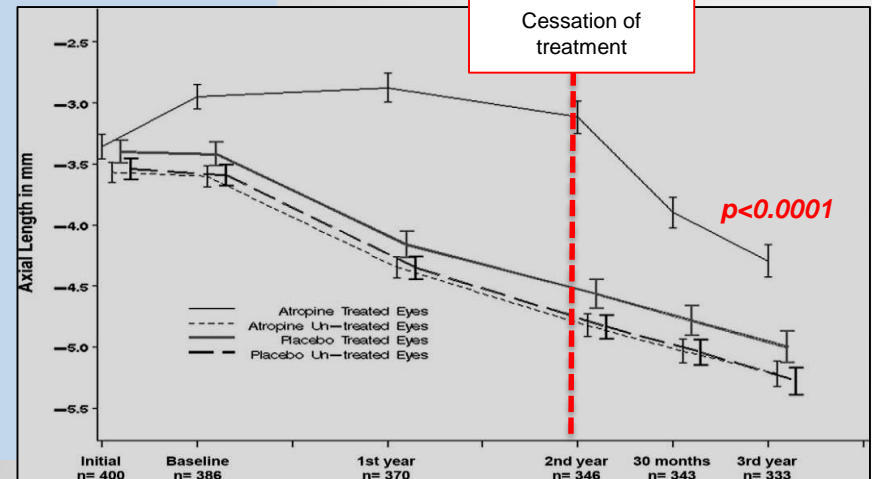
Wei-Han Chua, FRCS(Ed)(Ophth), FAMS,<sup>1,2</sup> Vivian Balakrishnan, FRCS(Ed), FRCOphth,<sup>1</sup>  
Yong-Huak Chan, PhD,<sup>3</sup> Louis Tong, FRCS(Ed),<sup>1</sup> Yvonne Ling, FRCS(Ed), FRCOphth,<sup>1</sup>  
Boon-Long Quah, FRCS(Ed), MMed(Ophth),<sup>1</sup> Donald Tan, FRCS(Ed), FRCOphth<sup>1,2,3</sup>



- RCT to assess the safety and efficacy of 1% atropine eyedrops in controlling myopia progression in children – 1991 to 2004
- 400 children, with placebo arm
- 3 year study: 2 years of treatment, 1 wash-out year

### Results

- **77% reduction** in mean progression of myopia
- but upon cessation: significant **rebound of myopia progression**
- Side-effects – pupil dilatation, loss of accommodation





# ATOM2 – lower concentrations



- Comparing safety and efficacy of **3 lower doses of atropine**
- double-masked RCT, 2006 to 2012
- 400 children
- Randomized: **0.5% (n=161)**  
**0.1% (n=155)**  
**0.01% (n=84)**
- **5 year study:**  
Treatment phase 1: 2 years of treatment  
Treatment phase 2: Year 3: wash-out year  
Treatment phase 3: Year 4,5: continuing progressors restarted on treatment with one dosage

## Atropine for the Treatment of Childhood Myopia: Safety and Efficacy of 0.5%, 0.1%, and 0.01% Doses (Atropine for the Treatment of Myopia 2)

Audrey Chia, FRANZCO,<sup>1,2</sup> Wei-Han Chua, FRCSEd(Ophth), FAMS,<sup>1,2</sup> Yin-Bun Cheung, PhD,<sup>3,4</sup> Wan-Ling Wong, Mbiostat,<sup>2</sup> Anushia Lingham, SRN,<sup>4</sup> Allan Fong, FRCSEd(Ophth),<sup>1,2</sup> Donald Tan, FRCS, FRCOphth<sup>1,2,5</sup>

Chia A, Chua WH, Cheung YB, Wong WL, Lingham A, Fong A, Tan D. Atropine for the treatment of childhood myopia: safety and efficacy of 0.5%, 0.1%, and 0.01% doses (Atropine for the Treatment of Myopia 2). *Ophthalmology* 2012;119(2):347-54.

## Atropine for the Treatment of Childhood Myopia: Changes after Stopping Atropine 0.01%, 0.1% and 0.5%

AUDREY CHIA, WEI-HAN CHUA, LI WEN, ALLAN FONG, YAR YEN GOON, AND DONALD TAN

Chia A, Chua WH, Wen L, Fong A, Goon YY, Tan D. Atropine for the treatment of childhood myopia: Changes after stopping Atropine 0.01%, 0.1% and 0.5%. *Am J Ophthalmol* 2014;157:451-457

AMERICAN ACADEMY  
OF OPHTHALMOLOGY  
The Eye M.D. Association

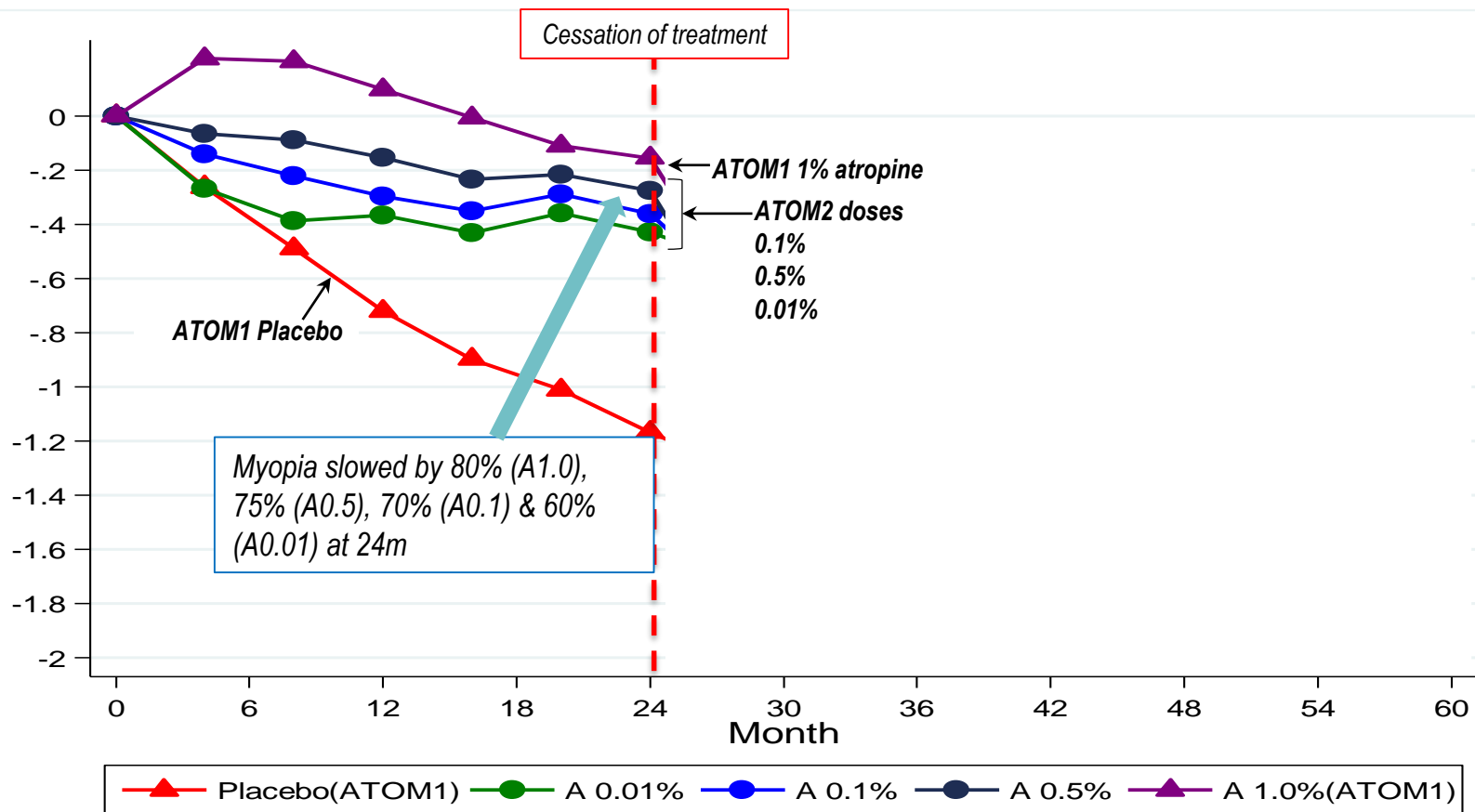
## Five-Year Clinical Trial on Atropine for the Treatment of Myopia 2

Myopia Control with Atropine 0.01% Eyedrops

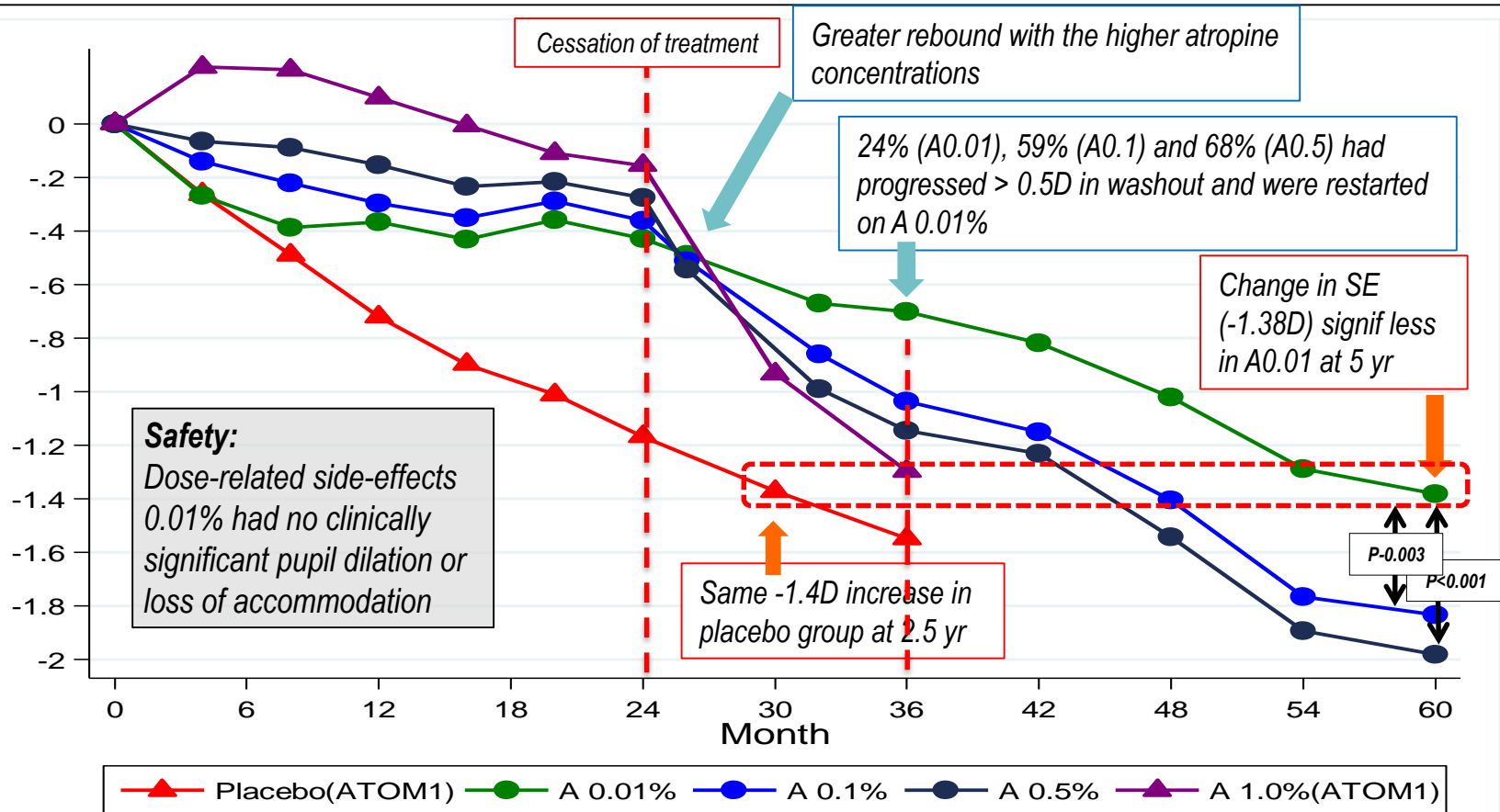
Audrey Chia, FRANZCO, PhD,<sup>1,2</sup> Qing-Shu Li, PhD,<sup>3,4</sup> Donald Tan, FRCS, FRCOphth<sup>1,2,4,5</sup>

Chia A, Chua WH, Wen L, et al. Atropine for the treatment of childhood myopia: changes after stopping atropine 0.01%, 0.1% and 0.5%. *Am J Ophthalmol*. 2014;157:451e457.e1.

# ATOM1 (3 year) and ATOM2 (5 year) data – Refraction Change

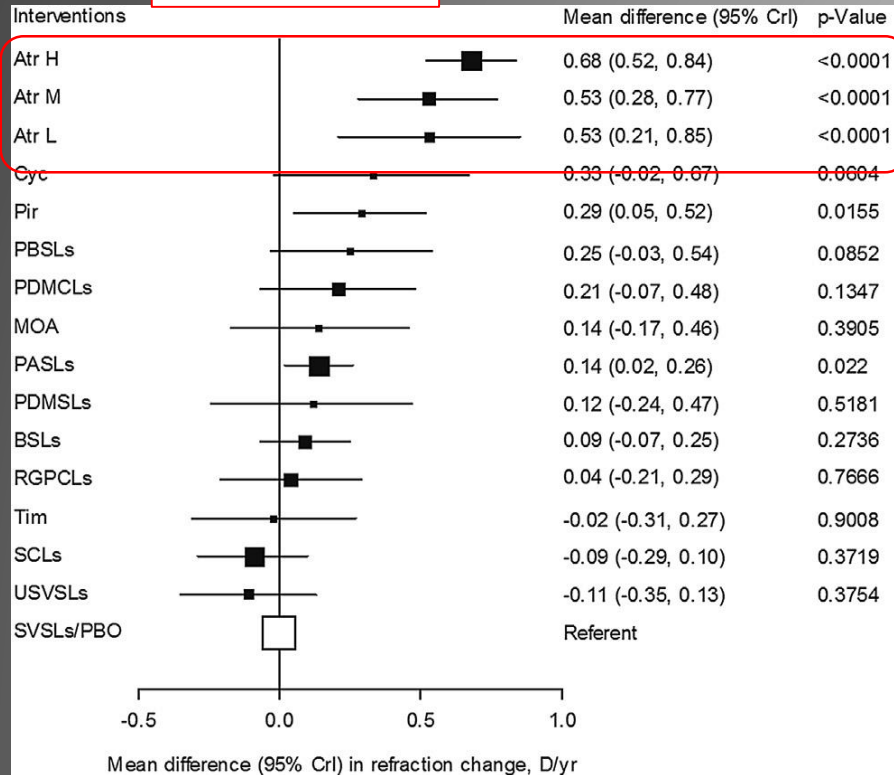


# ATOM1 (3 year) and ATOM2 (5 year) data – Refraction Change

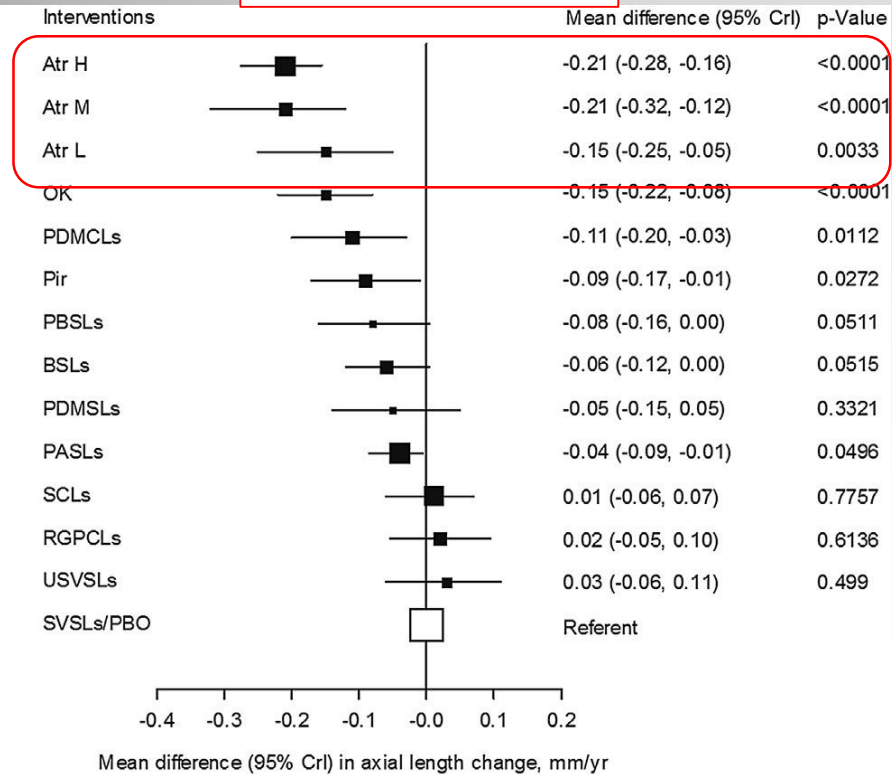


# Network Meta-analysis of Myopia Control Therapies

## Refractive Change

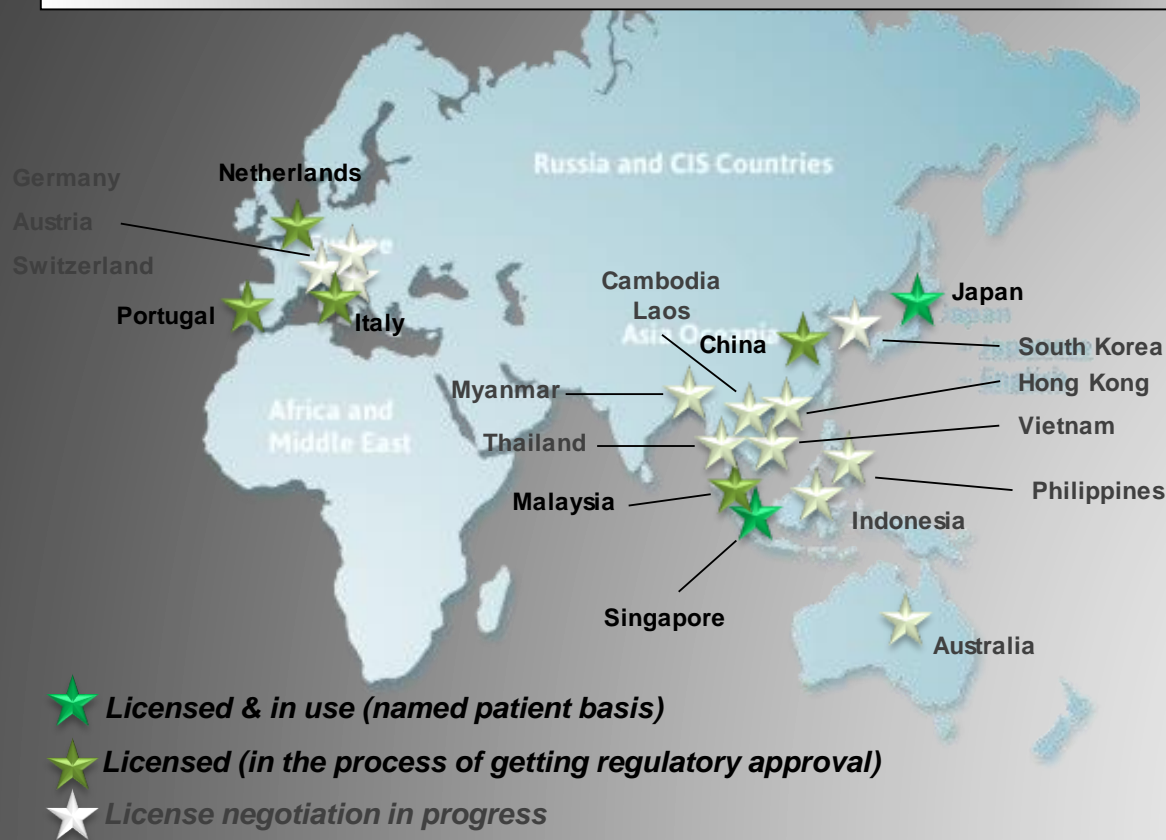


## Eyeball Length Change





## Commercialization: Atropine 0.01% Eyedrops: **Myopine™**



- In 2014, we launched **Myopine™**: 0.01% atropine eyedrops manufactured in a certified GMP and PIC/S certified pharmaceutical company in Malaysia
- Myopine approved for clinical use by Ministry of Health on a named patient basis
- Myopine also approved for clinical use under exemption status in **Japan**
- Under our Santen-SERI SONIC collaboration we have patented a new gel formulation of low-dose atropine – FIM RCT to be completed this year

## Current Trial...

# ATOM 3

## The Use of Atropine in the **PREVENTION** or **Delay of onset** of Myopia

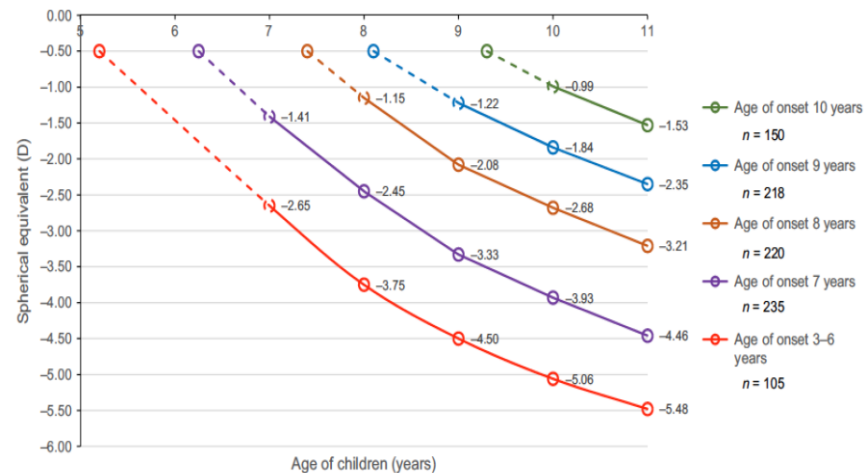
Chua S, Sabayanagam S, Cheung Y, Chia A, Valenzuela R, Tan D, T Wong, Ching C, Saw S. Ophthalmic Physiol Opt 2016;36:388-392

- Almost **90%** of Singapore schoolchildren will end up myopic
- We can safely predict that **5 year old children**, who are between **+1.0D to -0.49D**, will become myopic, and soon.. we call these children **Pre-Myopes**

**ATOM3 is a double-blind randomized placebo-controlled clinical trial to evaluate the use of atropine 0.01% in the prevention and control of myopia**

**Our Study Hypothesis : 0.01% atropine eyedrops, given to children **just prior to developing myopia**, may either **PREVENT** or **DELAY** the onset of myopia**

- Inclusion criteria: 5-9 yrs old, Pre-myopic children, at least one parent with myopia
- Randomized to receive 0.01% atropine or placebo drops for 2.5 yrs, washout period of 1 yr
- ATOM 3 initiated in June 2017

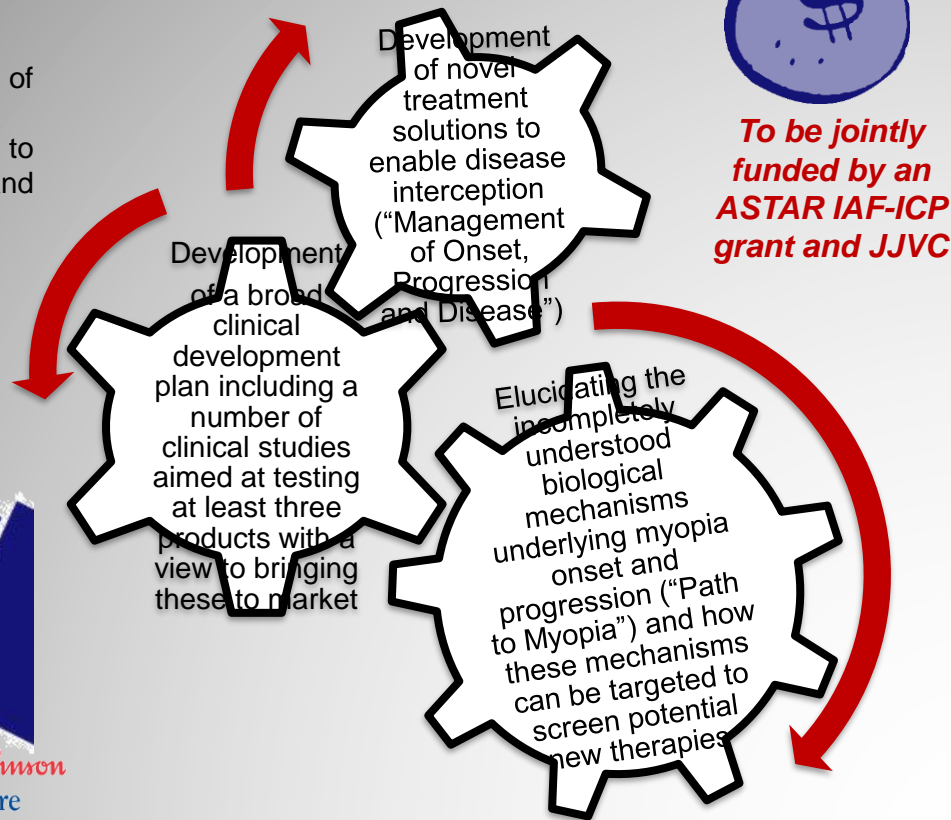
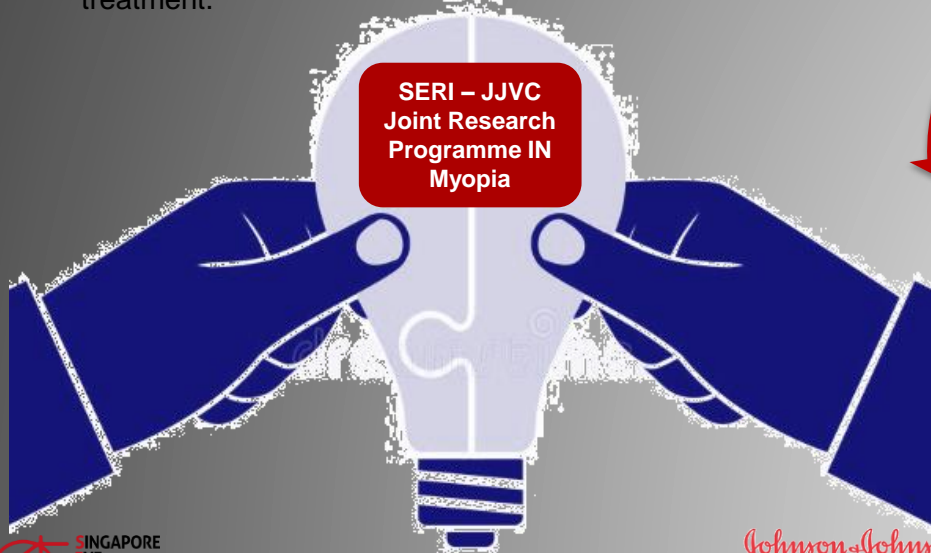


- **Younger age of onset associated with higher degrees of myopia** – higher SE and longer ALs
- Age of onset was the most important predictor for high myopia

# SERI – JJVC \$28M JOINT RESEARCH PROGRAMME IN MYOPIA

Global leadership in tackling the growing myopia epidemic in Asia, its causes, prevention and possible treatments through multidisciplinary research and data analytics focusing on:

- Myopia pathogenesis
- Disease management to prevent the onset and progression of myopia
- Developing novel therapies and interventions to prevent/slow/stop the disease by enhancing myopia control and treatment.



*Thank you for your attention...*



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