

Myopia-Management

Atropine, Contact lenses,
Outdoor & Digital Devices

Dr. Michael Bärtschi

Ph.D. in Biomedicine, FFAO/ARVO
M.Sc.Optom. et M.med.Education
mbaertschi@eyeness.ch

Swiss Academy
of Ophthalmology



Luzern, 7. March 2019

Disclosure

**No commercial or financial interest
in any product named in this lecture.**



Paid Consultant for:

ALCON Vision Care

COOPER Vision

GALIFA Contactlinsen

SENSIMED SA

APPENZELLER Kontaktlinsen

FALCO Contactlinsen

GELFLEX Laboratories

TECHCOLORS/Adventures in Colors

BOSTON Polymer Technology

Haag-Streit AG

JOHNSON & JOHNSON Vision Care

TISSOT Medical Research

DOWNLOAD

kontaktlinsenstudio bärtschi PORTRAIT DIENSTLEISTUNGEN PRODUKTE **NEWS** KONTAKT K2 - THE DOUBLE ⓘ D | E

eyeness®
wellness für ihre augen

SOCIAL MEDIA
EVENTS UND MEDIEN
DOWNLOADS
OFFENE STELLEN

DOWNLOADS

Wellness für ihre Augen - unser Leitgedanke. Wir geben Interviews, schreiben (Fach)Artikel oder stellen unsere Vision und Forschungsergebnisse an Vorträgen vor. Wir können nicht schweigen!

Hier haben wir für Sie alles zusammengestellt was sich so ansammelt an Vorträgen, Publikationen, Radiointerviews und Zeitungsbeiträgen.

Suchen nach Autor

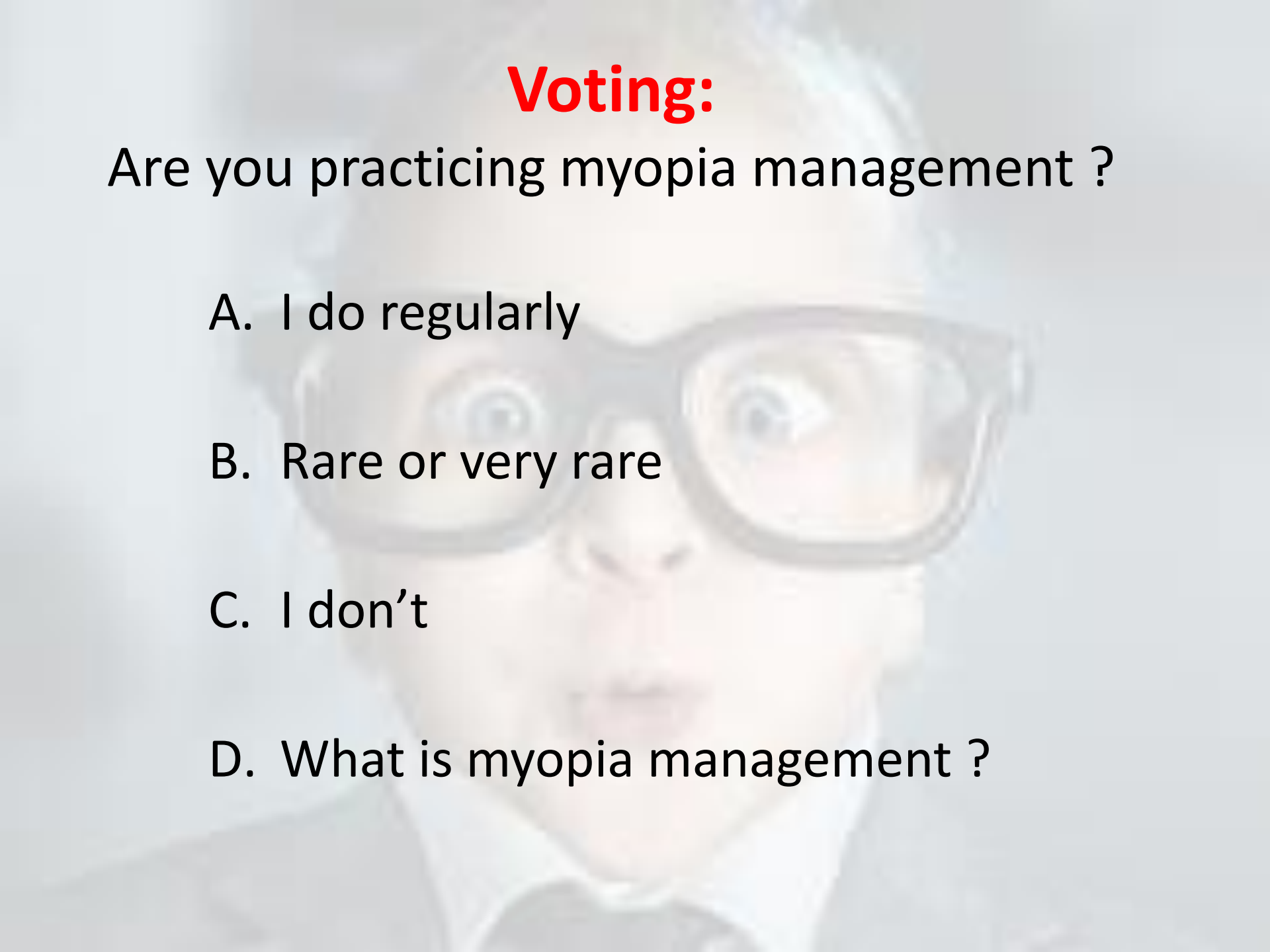
	Weitsicht in Extremis, "die Kontaktlinse"	1.51 MB	20.12.2018
	OCT und Fundus Workshop, Mediconsult Academy	5.33 MB	15.10.2018
	Optometrie im Alltag - Tag der Optometrie, München	3.03 MB	14.10.2018
	Use of therapeutic contact lenses in Epidermolysis Bullosa Dystrophica, DEBRA Congress	1.75 MB	09.09.2018
	Orthokeratologie und Presbyopie - Artikel "die kontaktlinse"	109.45 KB	15.08.2018
	much more than perfect vision - M.Sc. Kurs Benediktbeuren DE	3.58 MB	09.06.2018
	Weiche torische Kontaktlinsen bei Astigmatismus - ein Fallbericht / die kontaktlinse	4.75 MB	22.05.2018
	Tangible Issues, DEFA, Ulmria Club	1.42 MB	12.03.2018

NEUES ENT

eyeness ag, Hirschengraben 11, CH-3011 Bern, Telefon +41 (31) 311 07 66, info@eyeness.ch

NOTFÄLLE **↓ DOWNLOADS**

www.eyeness.ch



Voting:

Are you practicing myopia management ?

A. I do regularly

B. Rare or very rare

C. I don't

D. What is myopia management ?

Myopia-Management

- Kontrollierte Anwendung präventiver Massnahmen zur nachhaltigen Hemmung des Längenwachstums des Auges zwecks Minimierung krankhafter Folgeschäden.



Publications by End of February 2019

postoperative endophthalmitis - Google-Suche myopia control - PubMed - NCBI https://www.n

NCBI Resources ▾ How To ▾

PubMed.gov
US National Library of Medicine
National Institutes of Health

PubMed ▾ myopia control

Create RSS Create alert Advanced

Article types
Clinical Trial
Review
Customize ...

Text availability
Abstract
Free full text
Full text

Publication dates
5 years
10 years
Custom range...

Species
Humans
Other Animals

[Clear all](#)

Format: Summary ▾ **Sort by:** Most Recent ▾ **Per page:** 20 ▾ **Send to ▾**

Best matches for myopia control:

[Current approaches to myopia control.](#)
Leo SW et al. Curr Opin Ophthalmol. (2017)

[Myopia Control: A Review.](#)
Walline JJ et al. Eye Contact Lens. (2016)

[Interventions to Reduce Myopia Progression in Children.](#)
Tay SA et al. Strabismus. (2017)

Switch to our new best match sort order

Search results
Items: 1 to 20 of 3128

<< First < Prev Page 1 of 157 Next > Last >>

Global Epidemiology

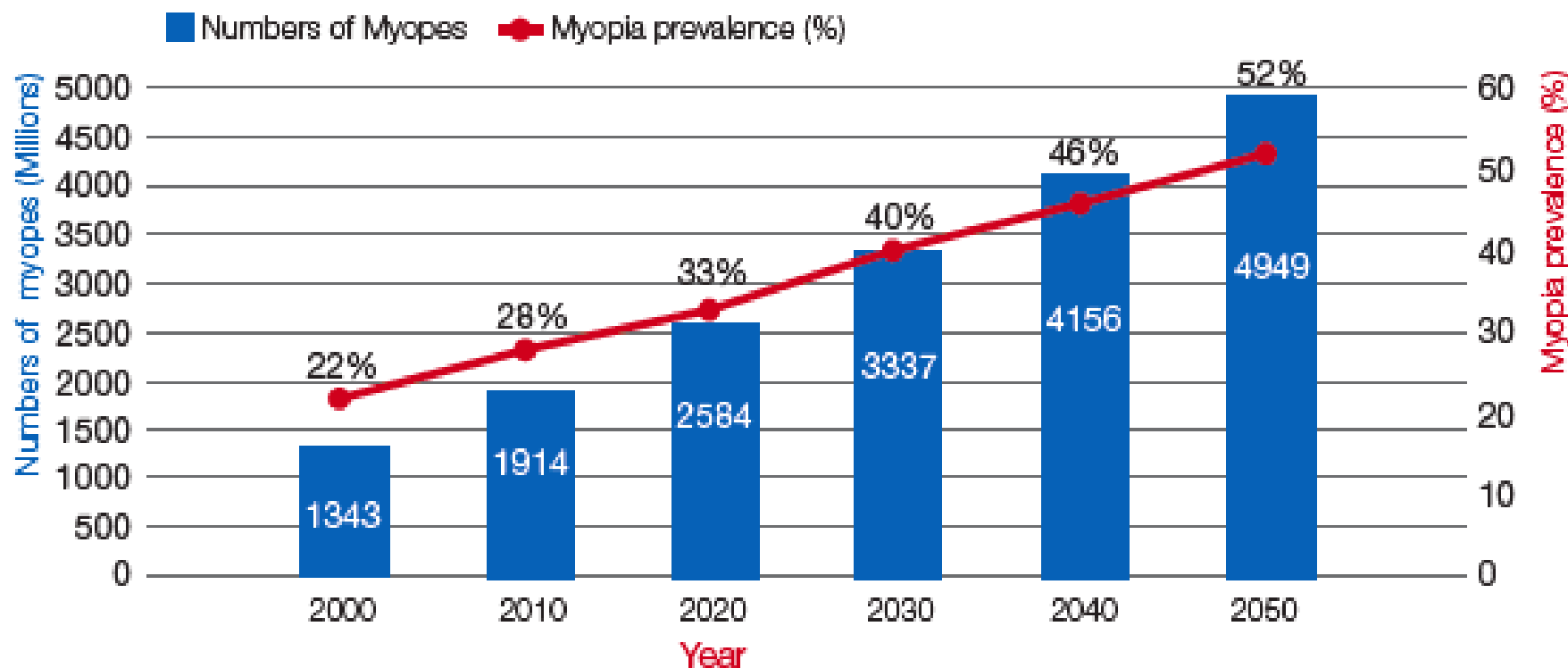
THE IMPACT OF MYOPIA AND HIGH MYOPIA

*Report of the Joint
World Health Organization–Brien Holden Vision Institute
Global Scientific Meeting on Myopia*

University of New South Wales, Sydney, Australia
16–18 March 2015



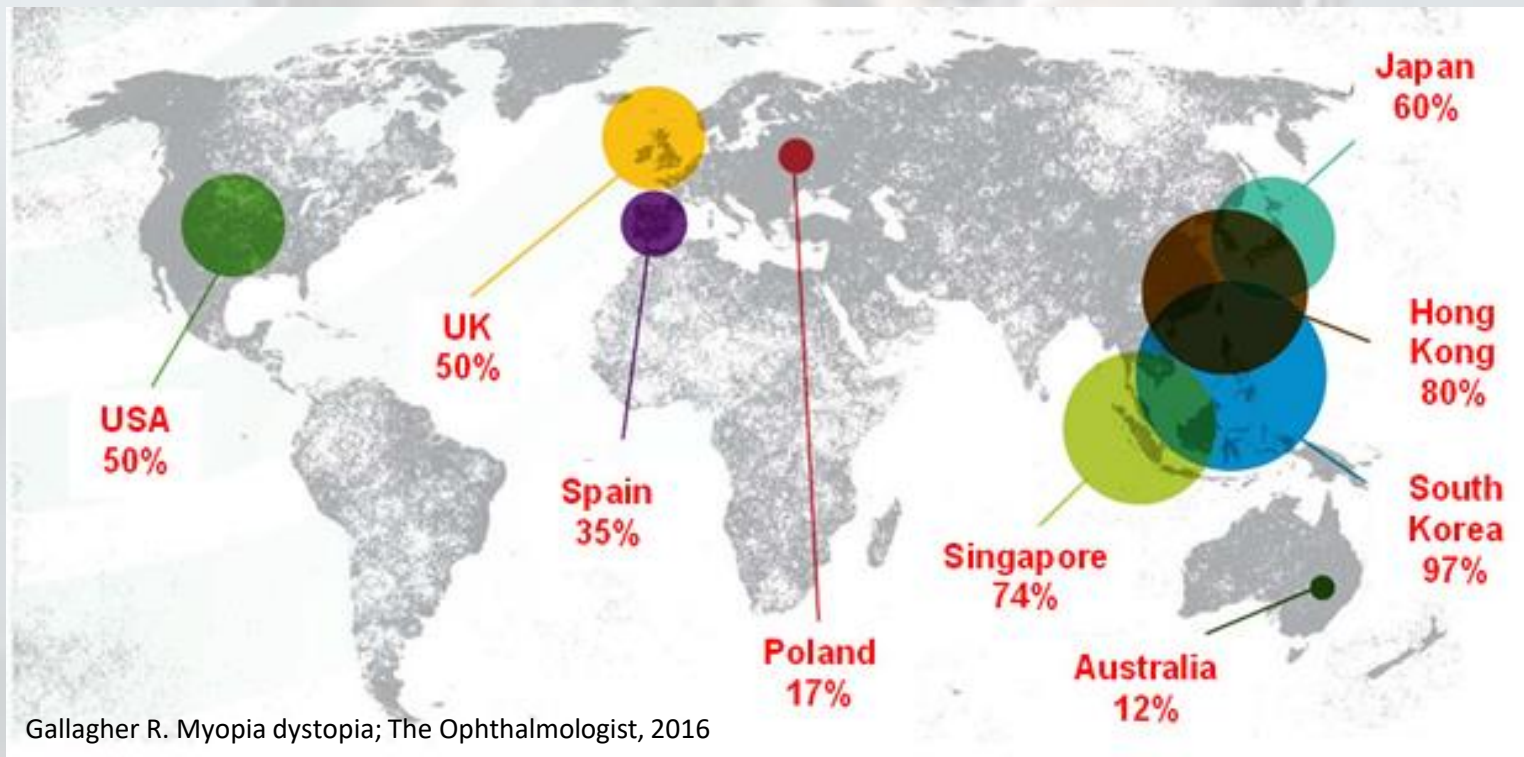
Results: Myopia - Now and in 2050



Epidemiology

“The actual global myopia prevalence is 28.3% of the world population (2 billion). With a strong increase tendency. In 2050 half of the world population will be myope. >4 billion people !”

Hopf und Pfeiffer: Der Ophthalmologe, 01/2017



Clinical Evidence



AMERICAN ACADEMY
OF OPHTHALMOLOGY®

Eye & Contact Lens • Volume 44, Number 4, July 2018

REVIEW ARTICLE

OPEN

A Review of Current Concepts of the Etiology and Treatment of Myopia

Jeffrey Cooper, M.S., O.D., F.A.A.O. and Andrei V. Tkatchenko, M.D., Ph.D.

- Myopic Macular Degeneration
- Ablatio Retinae
- Cataract
- Glaucoma



Risk (Odds) Ratio



AMERICAN ACADEMY
OF OPHTHALMOLOGY

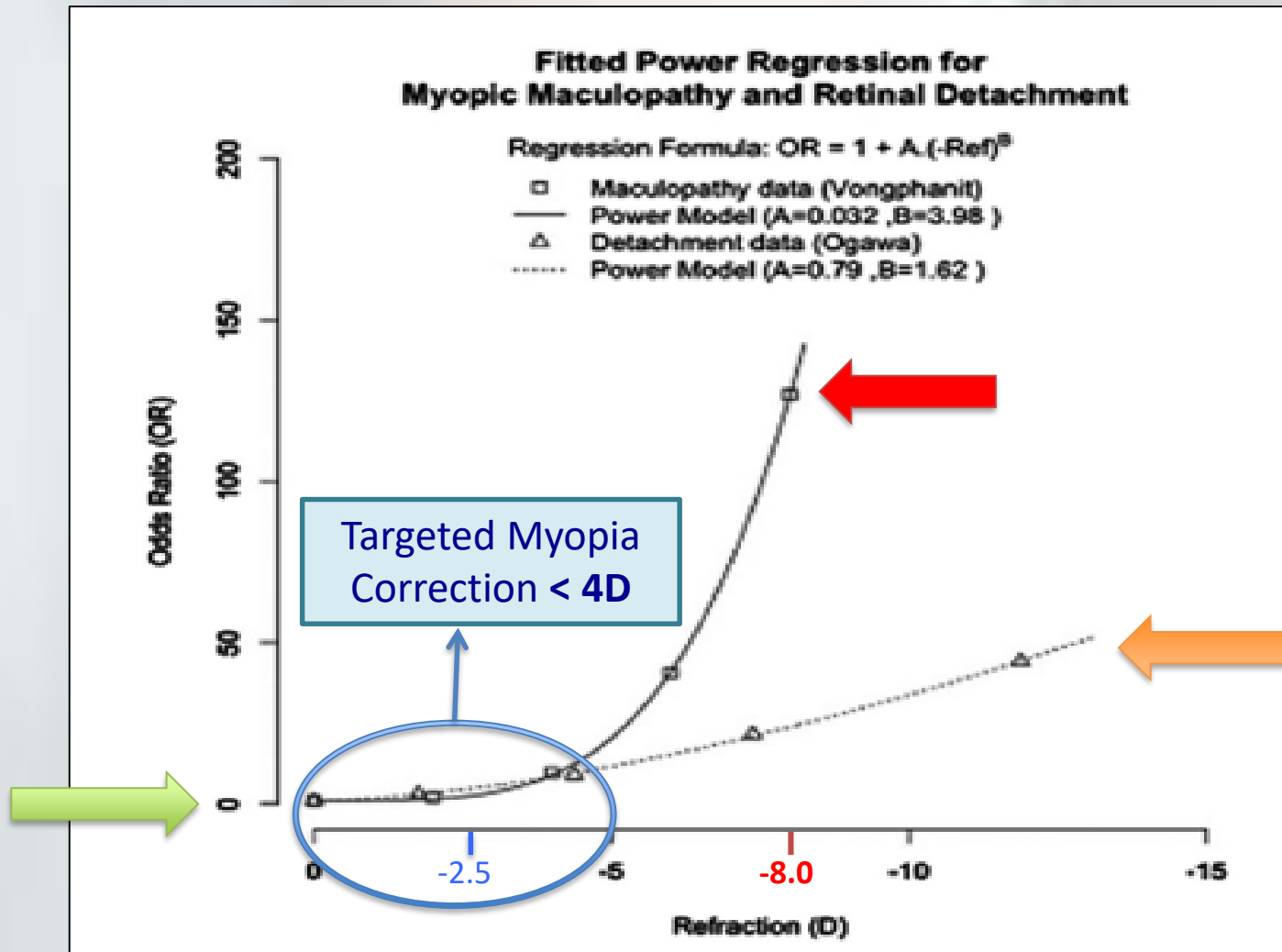
Eye & Contact Lens • Volume 44, Number 4, July 2018

REVIEW ARTICLE

OPEN

A Review of Current Concepts of the Etiology and
Treatment of Myopia

Jeffrey Cooper, M.S., O.D., F.A.A.O. and Andrei V. Tkatchenko, M.D., Ph.D.





Myopia Prevention and Outdoor Light Intensity in a School-Based Cluster Randomized Trial

Vol. 125/8,p.1239-50, August 2018

Pei-Chang Wu, MD, PhD,¹ Chueh-Tan Chen, MS,¹ Ken-Kuo Lin, MD,² Chi-Chin Sun, MD, PhD,³ Chien-Neng Kuo, MD,⁴ Hsiu-Mei Huang, MD,¹ Yi-Chieh Poon, MD,¹ Meng-Ling Yang, MD,² Chau-Yin Chen, MD,⁴ Jou-Chen Huang, MD,⁴ Pei-Chen Wu, MD,⁴ I-Hui Yang, MD,¹ Hun-Ju Yu, MD,¹ Po-Chiang Fang, MD,¹ Chia-Ling Tsai, DDS,⁵ Shu-Ti Chiou, PhD,^{6,7,8,*} Yi-Hsin Yang, PhD^{9,*}

„Currently, myopia maculopathy is the leading cause of blindness in Taiwan, Japan and China.“

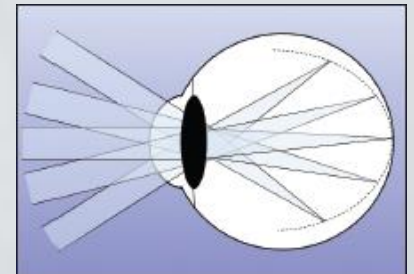
Ophthalmology, 2018

Causality

Multifactorial

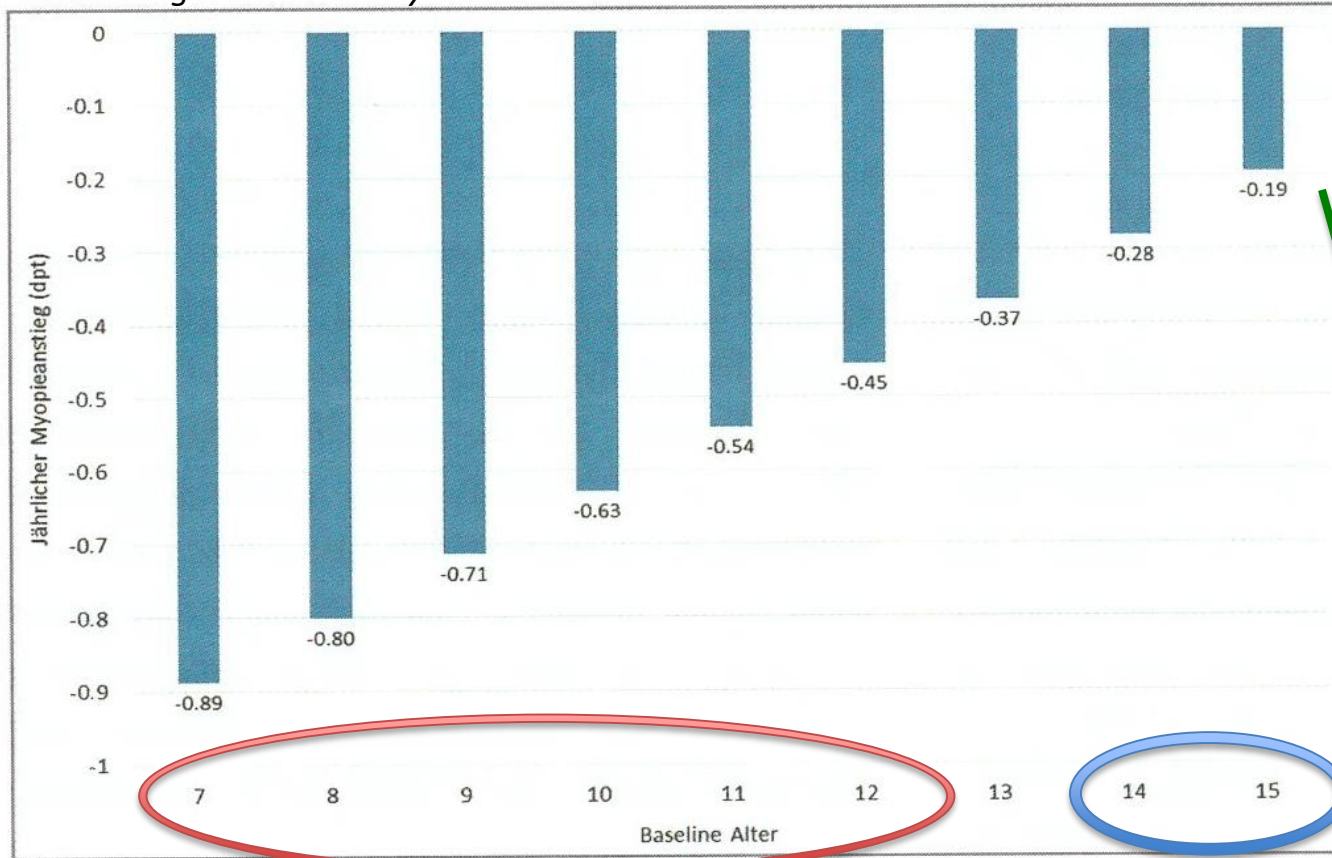
Many theories, often controversial results !

- **Genetics** (Wu und Edwards 1999, Morgan und Rose 2005, Foster und Jiang 2014)
- **Environment / Dopamin** (Feldkämper und Schäffel 2003, Jones et al 2007, Rose und Morgan 2008, Pan, Chen et al. 2015, Xiong et al 2017)
- **Emmetropization** (Xiang et al 2012, Zadnik et al 2015)
- **Close work / Digitalization** (McBrian et al 1993 (-), Lin et al 2004, Mutti und Zadnik 2009 (-), Wojciechowski 2011 (+), Mirshahi et al 2014 (+), Huang et al 2016 (-))
- **Accomodative lag /Esophoria** (Gwiazda et al 2004 (-), Cheng et al 2014 (+), Huang et al 2016 (-))
- **Peripheral Defocus**
(Smith et al 2005/2013, Atchinson et al 2005, Cagnolati et al 2011)



Myopia Progression by Age

Sankaridurg und Holden: Eye 2014



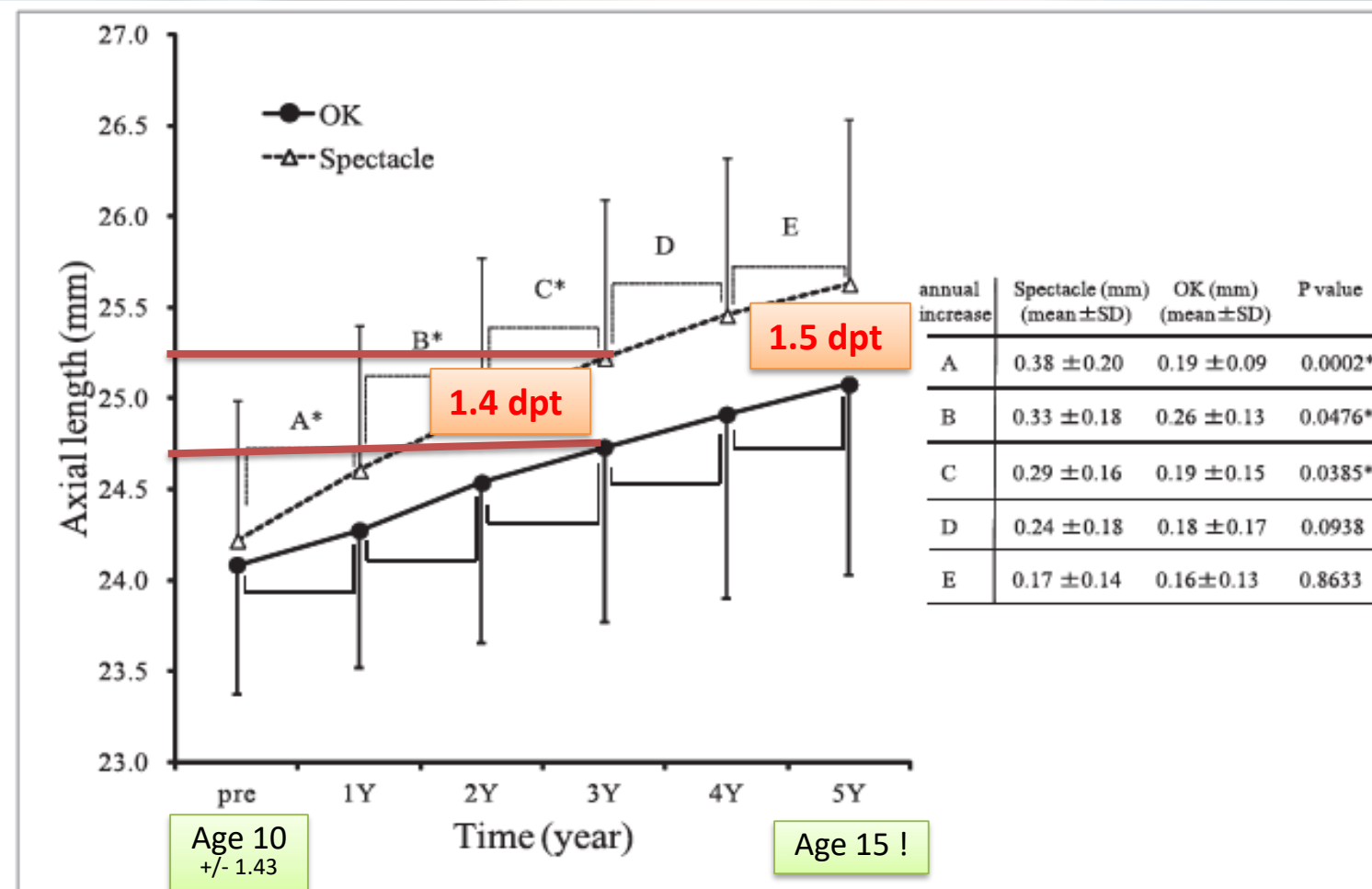
Therapy
STOP !?

„In most of our participants, Axial Length (AL) increases rapidly at younger ages and then slowed down and stabilized.“

Hou W. et al (COMET Group). Eye & Contact Lens: July 2018; Vol. 44/4, p.248-59

Long-Term Effect of Overnight Orthokeratology on Axial Length Elongation in Childhood Myopia: A 5-Year Follow-Up Study

Takabiro Hiraoka,¹ Tetsubiko Kakita,² Fumiki Okamoto,¹ Hideto Takahashi,³ and Tetsuro Oshika¹



Myopia Management

eyeness
managt das Auge



MYOPIE KONTROLLE

WARUM MYOPIE-KONTROLLE?

Die Anzahl Menschen mit einer Kurzsichtigkeit (Myopie) hat in den letzten Jahren massiv zugenommen, insbesondere in Asien. Eine Myopie kann sich bereits im Schulalter bemerkbar machen und sich in der Folge stetig verstärken. Dieses Längenwachstum des Auges stellt langfristig ein erhöhtes Gesundheitsrisiko dar. Das Risiko einer Netzhautablösung, als Beispiel, vervierfacht sich bereits bei 3 Dioptrien und liegt bei über 6 Dioptrien gar 16x höher.

GESUNDHEITSRISIKO NACH KORREKTUR

Fehlsichtigkeit	Grauer Star (Katarakt)	Grüner Star (Glaukom)	Netzhautablösung
-1.0 bis -3.0	2x	4x	4x
-3.0 bis -6.0	3x	4x	10x
-6.0 oder höher	5x	4x	16x



WIE ENTSTEHT EINE MYOPIE?

Ein Auge ist kurzsichtig, wenn es zu lang gebaut ist und dadurch die Lichtstrahlen beim Blick in die Ferne schon vor der Netzhaut zu einem Bild vereinen. Dadurch sieht man entfernte Gegenstände verschwommen.

Ein eigentlicher Auslöser oder Grund für dieses Längenwachstum ist bis dato noch nicht bekannt. Folgende Faktoren sind aber an einer Myopie-Entwicklung beteiligt. Damit erarbeiten wir mit ihnen zusammen Ihr persönliches Risikoprofil:

GENETIK > Familiengeschichte

Eltern nicht Myop	1 Elternteil ist Myop	Beide Eltern Myop
Tiefes Risiko	Mittleres Risiko (3x)	Hohes Risiko (6x)

VISUELLE EIGENSCHAFTEN > Korrektur

Altersgerecht	< als Altersgerecht	bereits Myop
Tiefes Risiko	Mittleres Risiko	Hohes Risiko

VISUELLE EIGENSCHAFTEN > Augen Zusammenspiel, Esophorie

Normal	Borderline	Überaktiv
Tiefes Risiko	Mittleres Risiko	Hohes Risiko

VISUELLE EIGENSCHAFTEN > Augen Zusammenspiel, Akkommodation

Normal	Borderline	Unteraktiv
Tiefes Risiko	Mittleres Risiko	Hohes Risiko

GEWOHNHEITEN > Outdoor Aktivitäten / Tag

2.7h oder mehr	1.6h bis 2.7h	weniger als 1.6h
Tiefes Risiko	Mittleres Risiko	Hohes Risiko

GEWOHNHEITEN > Naharbeiten / Tag, ausserhalb der Schulzeiten

unter 2h	2h bis 3h	mehr als 3h
Tiefes Risiko	Mittleres Risiko (2x)	Hohes Risiko (2-3x)

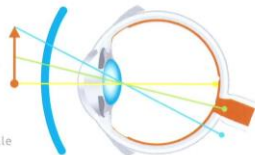
KANN MAN EINE MYOPIE-ENTWICKLUNG STOPPEN?

Ja, man kann!!! Seit Jahren werden umfangreiche Studien im Bereich der Myopie-Kontrolle durchgeführt. Neben den oben aufgeführten Faktoren ist es bei Kurzsichtigen so, dass die Umwelt nicht über die gesamte Netzhaut gleich scharf abgebildet wird. Es entsteht um den Brennpunkt des Auges ein unscharfer Ring, welcher mitverantwortlich für das Längenwachstum des Auges ist. Diesen Ring korrigiert man mit speziellen Kontaktlinsen so, dass die gesamte Netzhaut ein scharfes Bild erhält.

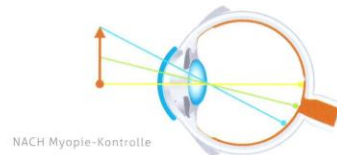
Bei frühzeitigen Gegenmassnahmen ist es also möglich, die negative Entwicklung deutlich zu verlangsamen.

Die folgende Tabelle zeigt eine Zusammenfassung der Verfahren zur Myopie-Kontrolle und deren Effektivität aus über 30 wissenschaftlichen Arbeiten:

VERFAHREN	VERLANGSAMUNG DER MYOPIE-ENTWICKLUNG IN %
Brillengläser und Standard Kontaktlinsen	0 – 5%
Multifokale / Bifokale Brillengläser	12 – 55%
Myovision (Spezial Brillengläser)	0 – 30%
Multifokale Kontaktlinsen	29 – 45%
Orthokeratologie / multifokale Orthokeratologie	32 – 100%
Atropin Augentropfen	30 – 77% (starke Nebenwirkungen)



VOR Myopie-Kontrolle



NACH Myopie-Kontrolle

UNSER ANGEBOT

INBEGRIFFENE LEISTUNGEN

- Die professionelle Anpassung – Erstkonsultation (90min) inklusive Anamnese, subjektive Refraktion, digitale Mikroskopie des vorderen Augenabschnittes, Topographie der Hornhaut, Hornhautdickenmessung, Augendruckmessung, Untersuchung der zentralen Netzhaut mittels Laser – Funduskamera und Computertomographie – Verträglichkeitstests (30min) nach 1 Woche und 1 Monat oder nach Bedarf
- Co-Management Augenarzt – regelmäßige Messung und Überprüfung der Augenlänge
- Komplettes Pflegemittelsystem und Zubehör
- Alle 6 Monate wird der Sitz der Kontaktlinsen und die Gesundheit der Augen genau kontrolliert.
- Regelmässiger Austausch der Kontaktlinsen

PREISE

Erstanpassung (einmalig):	
• Orthokeratologie	1060
• multifokale weiche Monatslinse	660
Monatliche Belastungen nach der Anpassung:	
• Myopie (Kurzsichtigkeit)	75
• Astigmatismus (Hornhautverkrümmung)	90

BEDINGUNGEN

Das Abo läuft mindestens 24 Monate (danach ist eine Kündigung des Abos halbjährlich möglich). Die Beträge werden monatlich mittels Lastschriftverfahren gebucht. Einfach und unkompliziert.

eyeness ag

Hirschengraben 11

Postfach

3001 Bern

Telefon 031 311 07 66

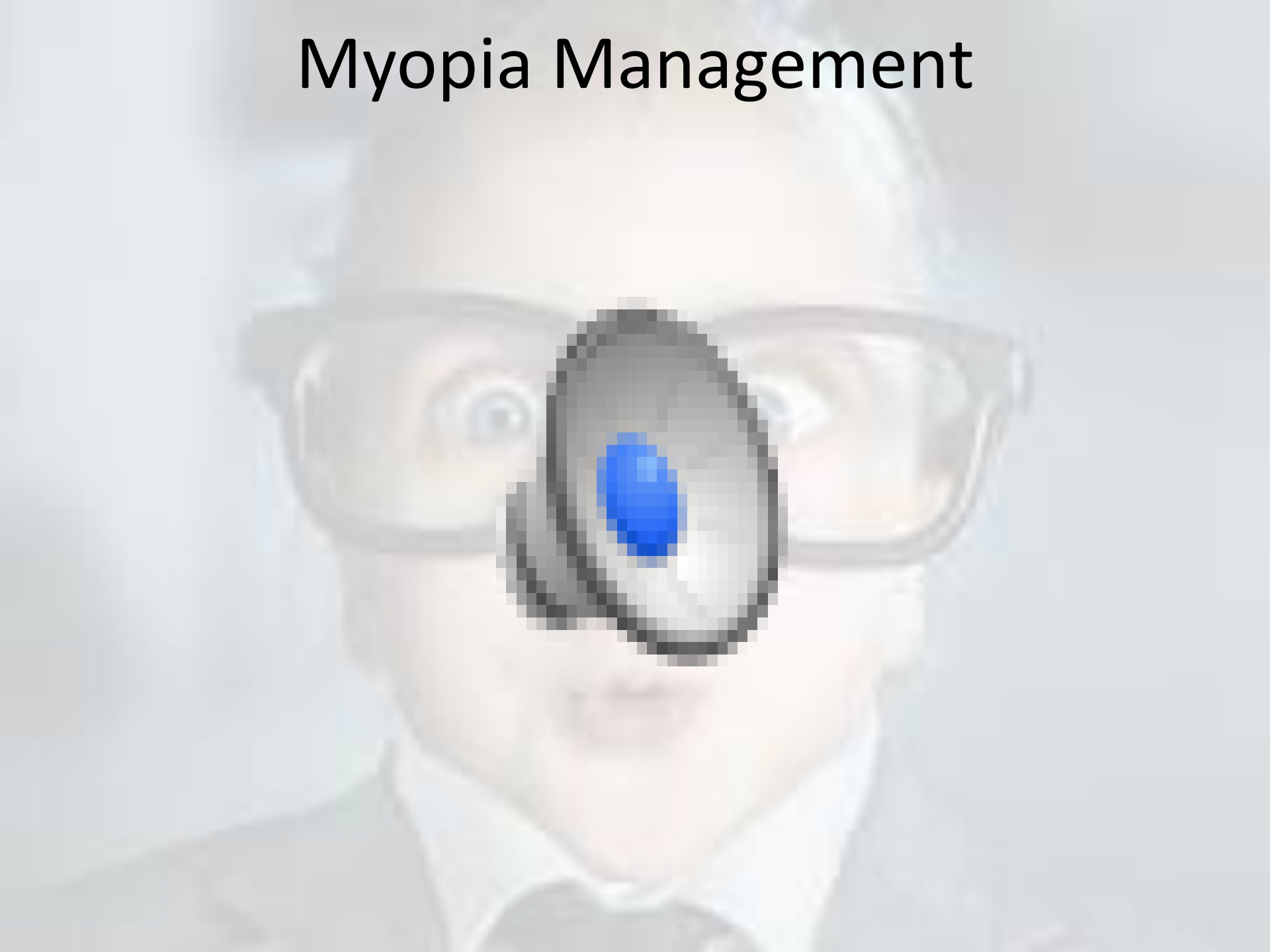
info@eyeness.ch

www.eyeness.ch

powered by kontaktlinsestudio bärtschi

Egal welches Verfahren zum Zuge kommt, wir arbeiten eng mit Ihrem Augenarzt zusammen und lassen die Augenlänge regelmässig nachmessen.

Myopia Management



Entscheidungshilfe

(Bsp. Brien Holden Vision Institute: Myopia Calculator)



Ethnicity

Caucasian

Child's Age (Years)

6

Refractive Error (D)

-1.00

Myopia Management Option

Peripheral defocus spectacles

Control Rate (%)

14

17

20

Peer Reviewed



Myopia Management Option:

Peripheral defocus spectacles

Percentage reduction in progression of myopia compared to standard correction e.g. single vision spectacles.

17%

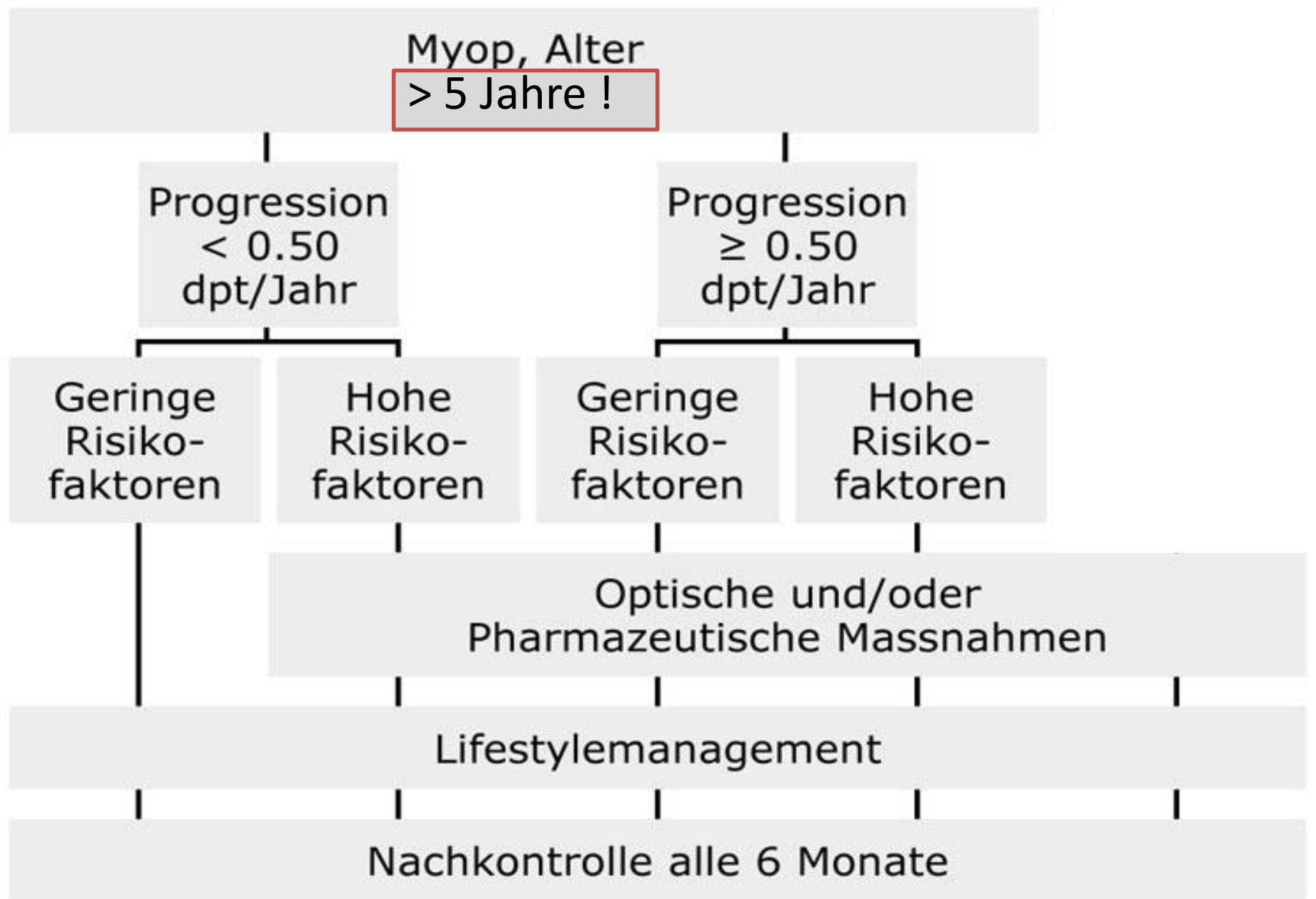
If treated with **Peripheral defocus spectacles** that provides 17% control, then the level of myopia at 17 may be:

-4.63D

If myopia control treatment is not commenced immediately, the final level of your child's myopia at 17 may be:

-5.37D

Entscheidungsschemata (Bsp. Galifa Augenblick revid.)



Actually most used and studied therapies

- Outdoor time **Update 2019**

(Planned and advertised, Digital Devices)



- Eye glasses

(prismatisch, bi-/multifokal, PDF, **DIMS**)



- Contact lenses

(bi-/multifokal, PDF, **Ortho-Keratology**)



- Pharmaceuticals

(**Atropine LAMP**, Pirenzepin)





Myopia Prevention and Outdoor Light Intensity in a School-Based Cluster Randomized Trial

Vol. 125/8,p.1239-50, August 2018

Pei-Chang Wu, MD, PhD,¹ Chueh-Tan Chen, MS,¹ Ken-Kuo Lin, MD,² Chi-Chin Sun, MD, PhD,³ Chien-Neng Kuo, MD,⁴ Hsiu-Mei Huang, MD,¹ Yi-Chieh Poon, MD,¹ Meng-Ling Yang, MD,² Chau-Yin Chen, MD,⁴ Jou-Chen Huang, MD,⁴ Pei-Chen Wu, MD,⁴ I-Hui Yang, MD,¹ Hun-Ju Yu, MD,¹ Po-Chiung Fang, MD,¹ Chia-Ling Tsai, DDS,⁵ Shu-Ti Chiou, PhD,^{6,7,8,*} Yi-Hsin Yang, PhD^{9,*}

- Extensive study (!) of *only* 12 months duration
- Mean age 6.34 years (SD 0.48)
- Interesting and practicable interventions
- “Myopic” shift 0.35D (Intervention) vs. 0.47D (control) $p=0.002$
- Axial length grow 0.28mm (Intervention= 0.84D) vs. 0.33mm (control= 0.99D) $p=0.003$
- Overlap of interventions turns study results questionable

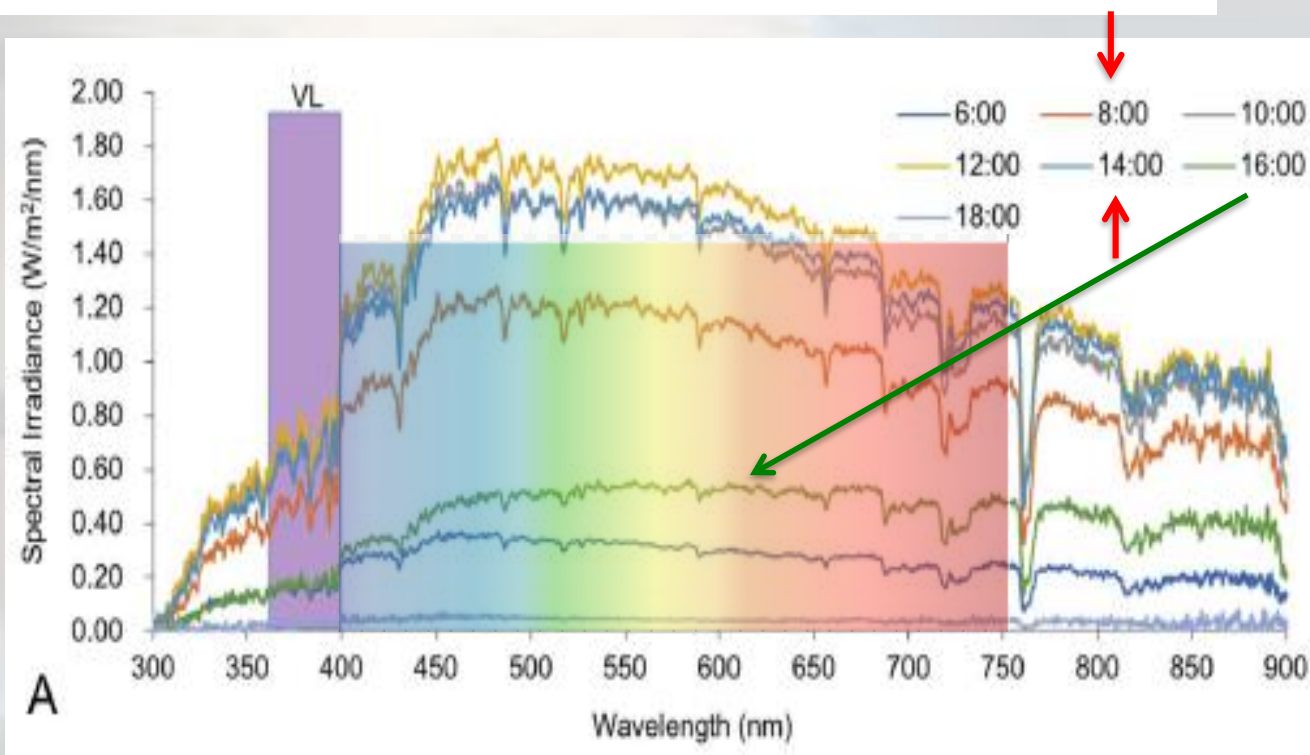
Table 1. Summary of Intervention Items between Recess Outside Classroom Trial 711 Program and Control Groups

Intervention items	Recess Outside Classroom Trial 711	Control
Recess outside classroom program	Yes	No
Outdoor-oriented school activities	Yes	No
Weekend sun-time passport assignment	Yes	No
Booklet for teacher-parent communication	Yes	No
Outdoor learning assignments in summer vacation	Yes	No
Eye health education for teachers and students, promote outdoor activity and 30/10 rule for myopia prevention.	Yes	Yes
Sport & Health 150: an initiative to promote an additional 150 minutes of exercise per week. This initiative was started during the late period of this study.	Yes	Yes
Tien-Tien 120: an initiative that promotes outdoor activities for 120 minutes daily. Although this initiative was not compulsory, 5% of the elementary schools in Taiwan were selected by the Bureau of Education for monitoring compliance with time outdoors. None of the schools in this study were among the selected schools.	Yes	Yes

30/10 = 30 minutes of near work followed by a 10-minute break.

Progress and Control of Myopia by Light Environments

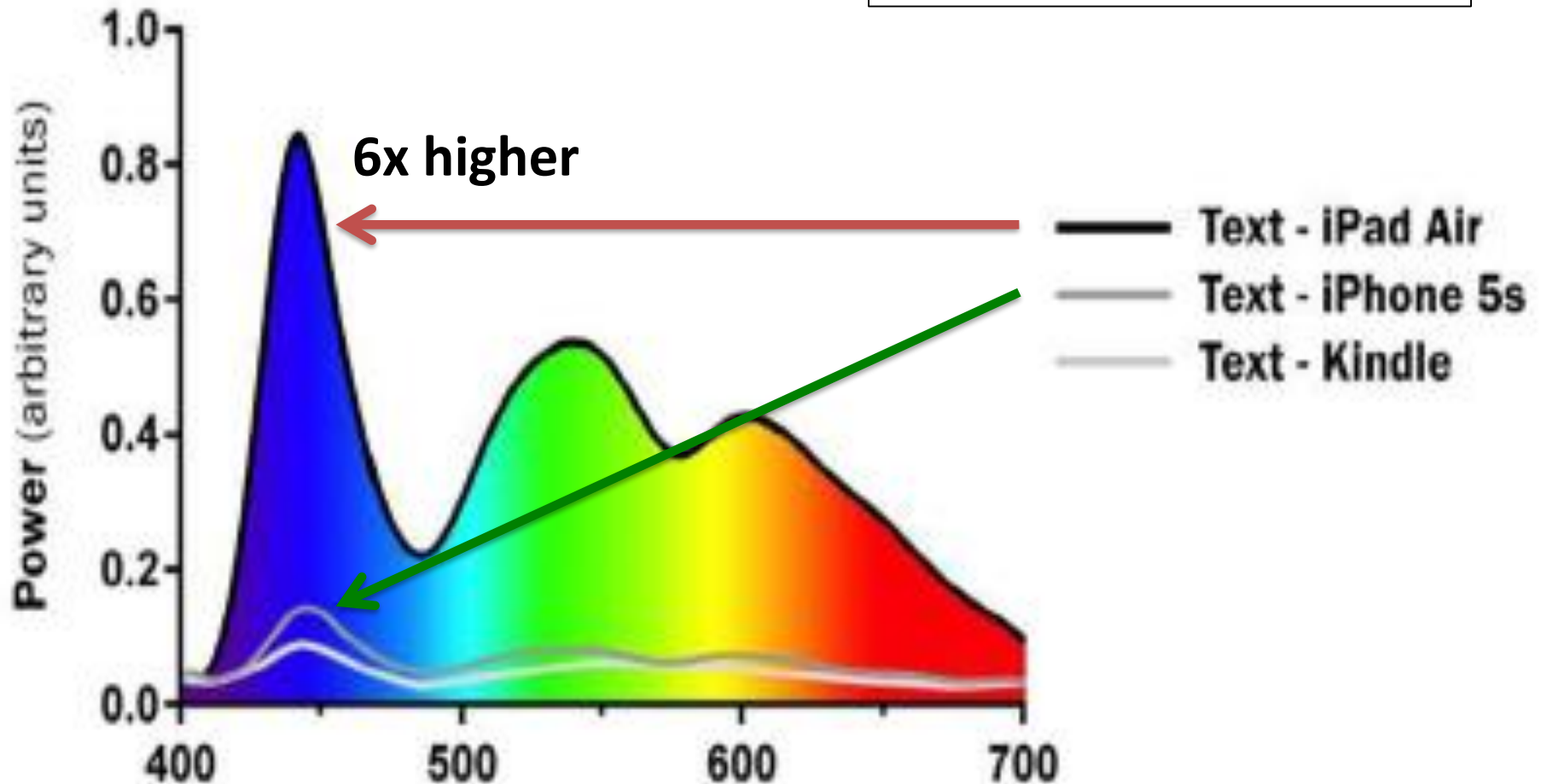
Xiaoyan Jiang, M.D., Toshihide Kurihara, M.D., Ph.D., Hidemasa Torii, M.D., Ph.D., and Kazuo Tsubota, M.D., Ph.D.





Digital devices ?

Tablet vs Smartphone



How bright are electronic devices?

TABLE 2 | Spectral distribution of human retinal photopigment-weighted measures from all light-emitting devices during different display conditions.

Prefix	Sensitivity	α -opic lux						
		Angry Birds ipad	Angry birds phone	Kids sleep Dr	Text ipad	Text ipad glasses	Text kindle	Text phone
Cyanopic	S cone	244.44	63.03	27.68	409.18	59.23	46.95	71.52
Melanopic	Melanopsin	176.25	46.49	31.51	302.33	64.55	34.62	54.54
Rhodopic	Rod	180.07	45.04	39.65	313.43	93.68	35.64	53.92
Chloropic	M cone	174.03	41.96	71.55	314.00	154.16	37.56	52.04
Erythroptic	L cone	162.66	39.72	112.96	306.52	199.93	37.68	50.49
Photopic lux	lux	170.42	40.32	104.95	318.52	201.89	38.67	51.40
Irradiance	$\mu W/cm^2$	60.20	16.40	39.10	110.80	62.30	14.30	19.80
Photon flux	$1/cm^2/s$	$1.64E+14$	$4.44E+13$	$1.18E+14$	$3.66E+14$	$1.85E+14$	$3.90E+13$	$5.85E+13$
Peak spectral irradiance	nm	445	450	610	445	605	455	450

The ability of the light devices to stimulate the human photopigments in the eye was assessed and is presented in this table.

The potential ability of each light source to stimulate the S-cone (cyanopic), M-cone (chloropic), L-cone (erythroptic), rods (rhodopic), and melanopsin (melanopic) photopigments, corrected for pre-receptor filtering, was evaluated (16). The S-, M-, and L-cones make up the trichromatic visual system and melanopsin is the blue light sensitive irradiance detecting photopigment that is the primary contributor to the non-visual responses to light.

Light intensity irradiance is measured in microwatt per square centimeter. Photon flux is the number of photons that get delivered by the device per square centimeter per second.

Peak spectral irradiance is the wavelength (nanometer) of the peak where the irradiance is highest.

Gringras P, Middleton B, Skene DJ, Revell VL. Bigger, Brighter, Bluer-Better? Current Light-Emitting Devices - Adverse Sleep Properties and Preventative Strategies. Front Public Health. 2015;3:233.

Electronic devices are dim compared to outside lighting





Research Paper

Violet Light Exposure Can Be a Preventive Strategy Against Myopia Progression



Hidemasa Torii ^{a,b}, Toshihide Kurihara ^{a,b}, Yuko Seko ^c, Kazuno Negishi ^a, Kazuhiko Ohnuma ^d, Takaaki Inaba ^{a,e}, Hiro Kondo ^a, Maki Miyauchi ^{a,b}, Yukihiro Miwa ^{a,b}, ^f, Kinya Tsubota ^{b,g}, Hiroshi Goto ^g, Mayumi Oda ^h,

^a Maki Miyauchi, Shinjuku-ku, Tokyo 160-8582, Japan

^b Maki Miyauchi, Shinjuku-ku, Tokyo 160-8582, Japan

^c Research Institute, National Rehabilitation Center for Persons with Disabilities, Tokorozawa-shi, Saitama 359-8555, Japan

^d Shinjuku-ku, Chiba 263-8522, Japan

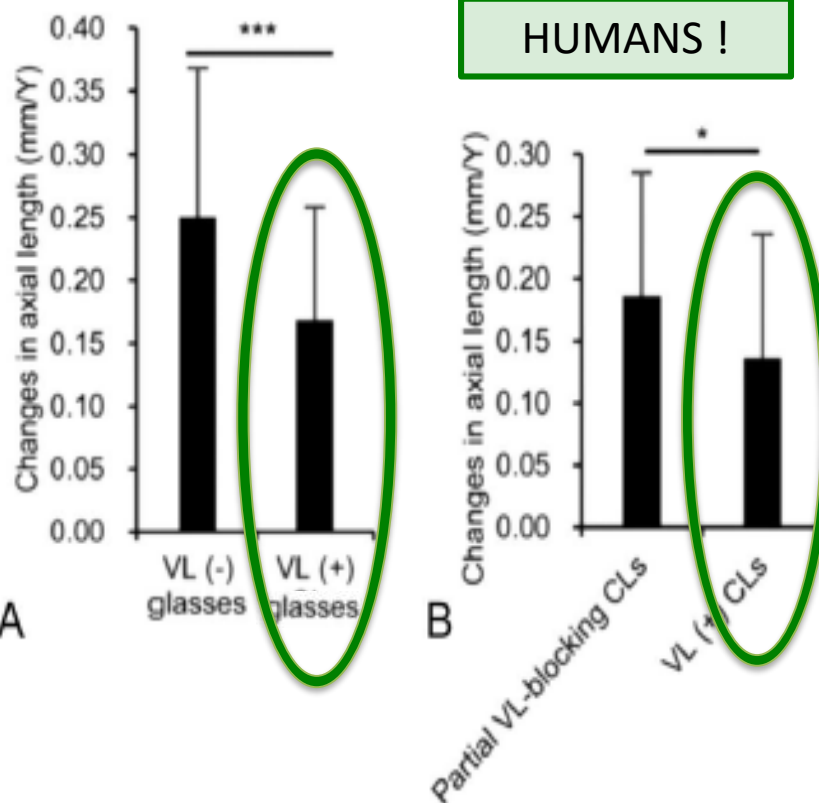
^e 8916-16 Takayama-cho, Ikoma-shi, Nara 630-0101, Japan

^f 81-3627, Japan

^g Shinjuku-ku, Tokyo 160-0023, Japan

^h University School of Medicine, 35 Shinanomachi, Shinjuku-ku, Tokyo 160-8582, Japan

75, Japan



protein 1 (EGR-1) in the chick retina, which showed that VL might prevent myopia through pathways independent to other wavelengths. The mechanism behind VL for myopia control must not be simple, and more works still need to be performed. Recently, we

Environment and humans !

- “Increased time outdoors is effective in preventing the onset of myopia as well as in slowing down the myopic shift in refractive error. But paradoxically, outdoor time was not effective in slowing progression in eyes that were **already myopic.**”

(Xiong et al.: Meta-Analyse/Review, Acta Ophthalmologica 2017)



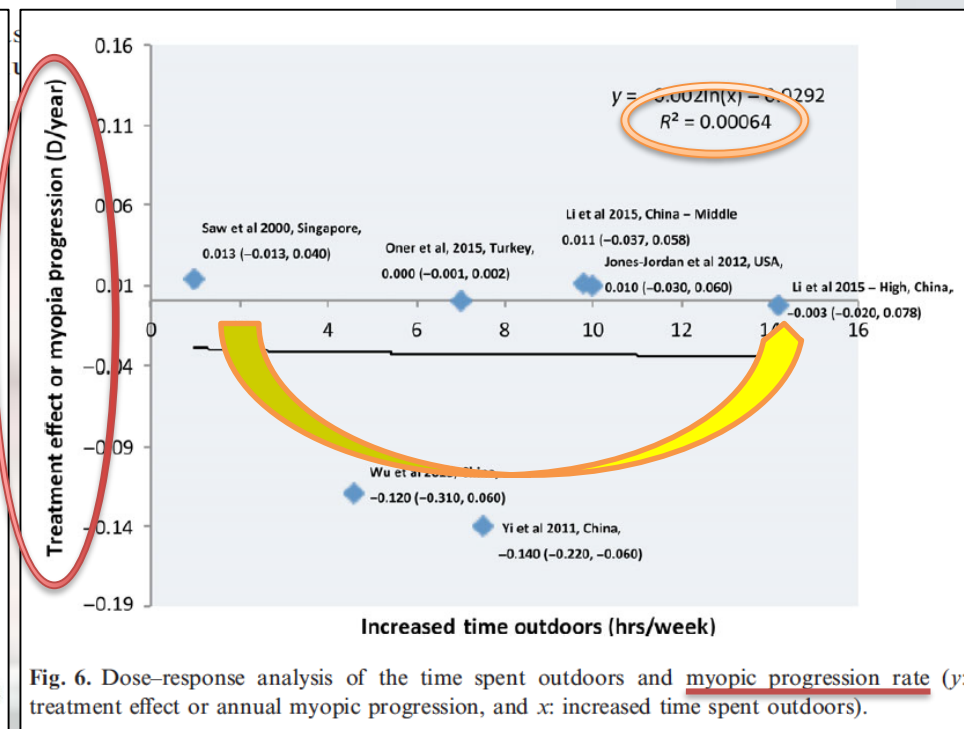
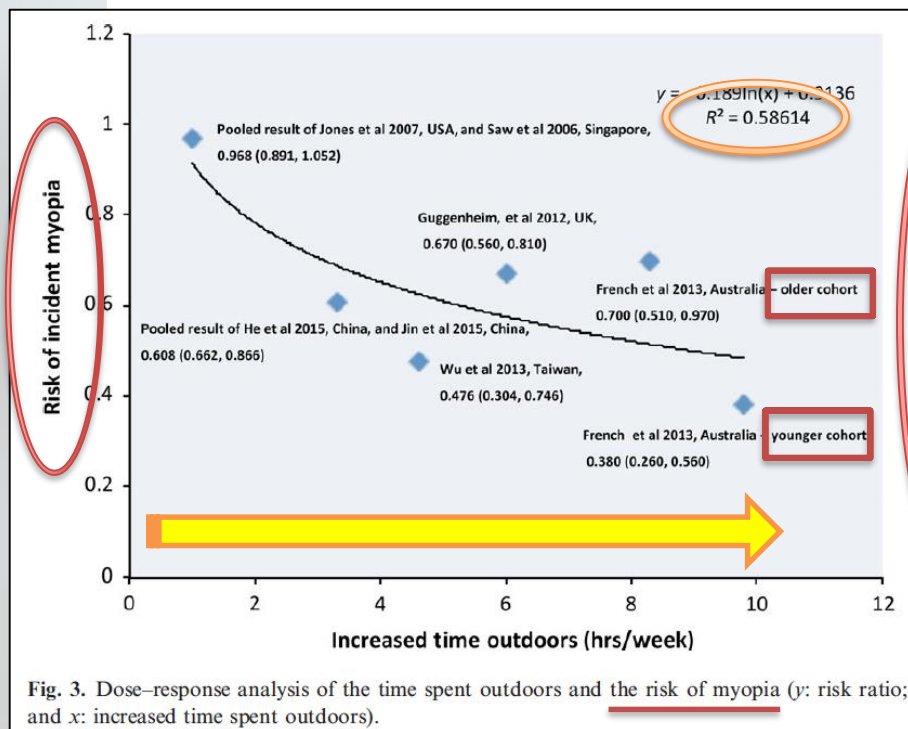
Fact Check Environment

Acta Ophthalmologica

ACTA OPHTHALMOLOGICA 2017

Review Article

Time spent in outdoor activities in relation to myopia prevention and control: a meta-analysis and systematic review





Low-Concentration Atropine for Myopia Progression (LAMP) Study

A Randomized, Double-Blinded, Placebo-Controlled Trial of 0.05%, 0.025%, and 0.01% Atropine Eye Drops in Myopia Control

Jason C. Yam, FCOphthHK, FRCS(Edin),¹ Yuning Jiang, MMED,¹ Shu Min Tang, PhD,¹
Antony K.P. Law, MSc,¹ Joyce J. Chan, MRCSEd(Ophth),¹ Emily Wong, MBChB, MRCS(Edin),¹
Simon T. Ko, FCOphthHK, FHKAM(Oph),² Alvin L. Young, MMedSc(Hons), FRCOphth,^{1,3}
Clement C. Tham, FCOphthHK, FRCOphth,¹ Li Jia Chen, MRCSEd(Ophth), PhD,^{1,3} Chi Pui Pang, DPhil¹

Age (yrs)	8.45	1.81	8.54	1.71	8.23	1.83	8.42	1.72	0.62
-----------	------	------	------	------	------	------	------	------	------

Spherical equivalent (D)	-3.98	1.69	-3.71	1.85	-3.77	1.85	-3.85	1.95	0.72
--------------------------	-------	------	-------	------	-------	------	-------	------	------

> 14 h / week !

Outdoor activity (hours per day)*	2.28	0.89	2.04	0.81	2.20	0.92	2.30	1.04	0.15
-----------------------------------	------	------	------	------	------	------	------	------	------

Nearwork (dioptric hours per day) ^{††}	15.65	3.94	15.22	4.34	16.13	5.94	14.96	4.95	0.30
---	-------	------	-------	------	-------	------	-------	------	------

> 15 h / day !

Efficacy of actual therapies



AMERICAN ACADEMY™
OF OPHTHALMOLOGY

Ophthalmology 2016



CrossMark

Efficacy Comparison of 16 Interventions for Myopia Control in Children

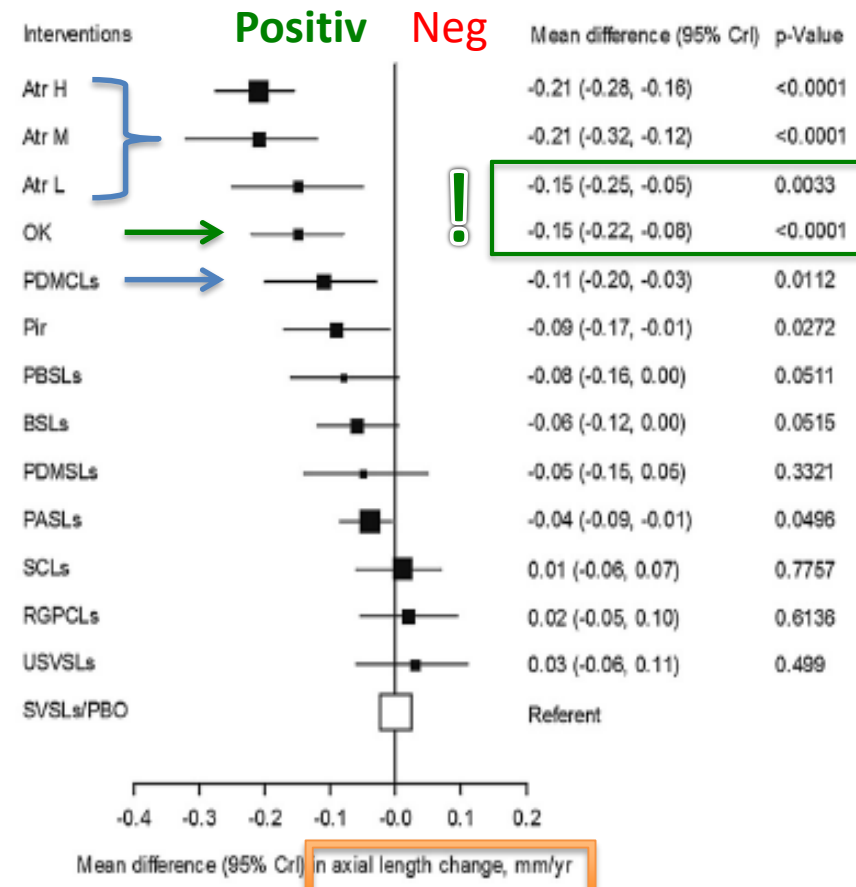
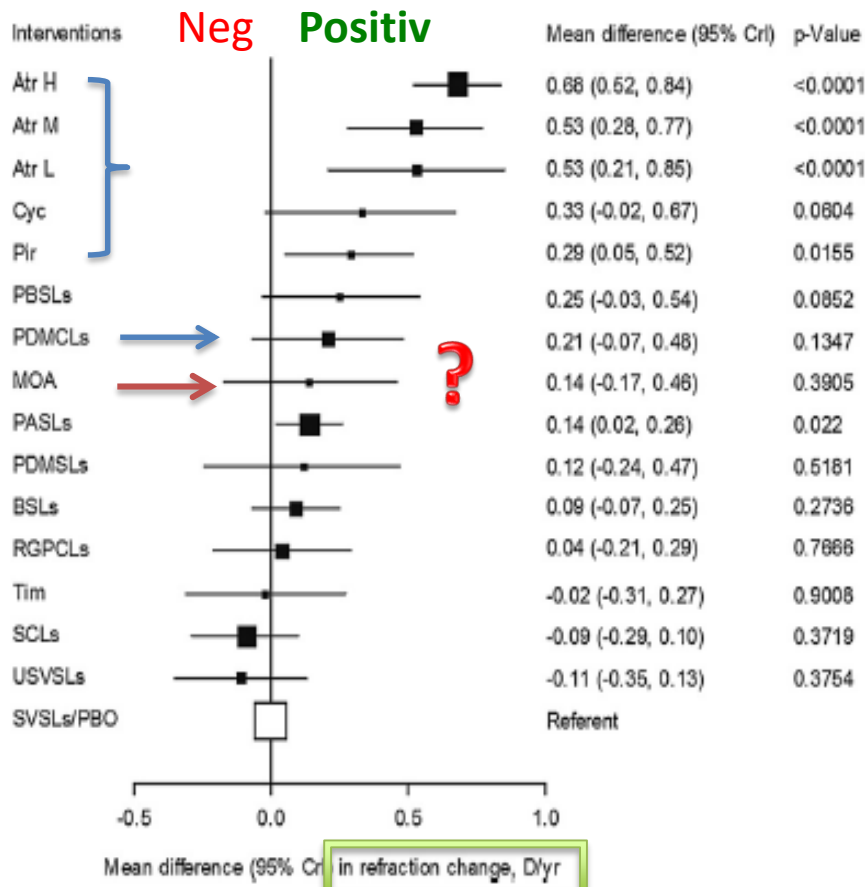
A Network Meta-analysis

change: -0.04 [-0.09 to -0.01]) showed slight effects.

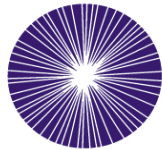
Conclusions: This network analysis indicates that a range of interventions can significantly reduce myopia progression when compared with single vision spectacle lenses or placebo. In terms of refraction, atropine, pirenzepine, and progressive addition spectacle lenses were effective. In terms of axial length, atropine, orthokeratology, peripheral defocus modifying contact lenses, pirenzepine, and progressive addition spectacle lenses were effective. The most effective interventions were pharmacologic, that is, muscarinic antagonists such as atropine and pirenzepine. Certain specially designed contact lenses, including orthokeratology and peripheral defocus modifying contact lenses, had moderate effects, whereas specially designed spectacle lenses showed minimal effect. *Ophthalmology* 2016;123:697-708 © 2016 by the American Academy of Ophthalmology. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Efficacy of actual therapies

Huang et al • Network Meta-analysis: Interventions for Myopia



Atr . atropine; Atr H . high-dose atropine (1% or 0.5%); Atr L . low-dose atropine (0.01%); Atr M . moderate-dose atropine (0.1%); BSLs . bifocal spectacle lenses; CrI . credible interval; Cyc . cyclopentolate; MOA . more outdoor activities (14e15 hrs/wk); OK . orthokeratology; PASLs . progressive addition spectacle lenses; PBO . Placebo; PBSLs . prismatic bifocal spectacle lenses; PDMCLs . peripheral defocus modifying contact lenses; PDMSLs . peripheral defocus modifying spectacle lenses; Pir . pirenzepine; RGPClS . rigid gas-permeable contact lenses; SCLs . soft contact lenses; SVSLs . single vision spectacle lenses; Tim . Timolol; USVSLs . undercorrected single vision spectacle lenses.



AMERICAN ACADEMY
OF OPHTHALMOLOGY®

Eye & Contact Lens • Volume 44, Number 4, July 2018

REVIEW ARTICLE

OPEN

A Review of Current Concepts of the Etiology and Treatment of Myopia

Jeffrey Cooper, M.S., O.D., F.A.A.O. and Andrei V. Tkatchenko, M.D., Ph.D.



AMERICAN ACADEMY
OF OPHTHALMOLOGY®

Ophthalmology Volume 126, Number 1, January 2019

Low-Concentration Atropine for Myopia Progression (LAMP) Study

A Randomized, Double-Blinded, Placebo-Controlled Trial of 0.05%, 0.025%, and 0.01% Atropine Eye Drops in Myopia Control

Jason C. Yam, FCOphthHK, FRCS(Edin),¹ Yuning Jiang, MMED,¹ Shu Min Tang, PhD,¹
Antony K.P. Law, MSc,¹ Joyce J. Chan, MRCSEd(Ophth),¹ Emily Wong, MBChB, MRCS(Edin),¹
Simon T. Ko, FCOphthHK, FHKAM(Oph),² Alvin L. Young, MMedSc(Hons), FRCOphth,^{1,3}
Clement C. Tham, FCOphthHK, FRCOphth,¹ Li Jia Chen, MRCSEd(Ophth), PhD,^{1,3} Chi Pui Pang, DPhil¹

Atropine 0.5% vs 0.1% vs 0.01%

ATOM 2 Study

- “Over 5 years, atropine 0.01% eye drops were more effective in slowing myopia progression with less visual side effects compared with higher doses of atropine.” Chia, Lu, Tan: Ophthalmology 2016



What means “Less side effects” ?

Table 4. Changes in Pupil Size, Accommodation, and Visual Acuity in Children within Different Atropine Groups (0.01%, 0.1%, and 0.5%) Who Were Re-treated and Who Did Not Require Re-treatment

	Re-treated Children		Untreated Children			
	Atropine 0.01% (N = 17)	P Value	Atropine 0.01% (N = 53)	Atropine 0.1% (N = 57)	Atropine 0.5% (N = 43)	P Value
Photopic pupil size, mm, mean (SD)						
Screening	3.93 (0.56)	0.872	3.89 (0.58)	3.86 (0.67)	4.02 (0.60)	0.363
24 mos	5.18 (1.02)	<0.001	5.02 (0.92)	6.46 (1.07)	7.28 (1.46)	<0.001
36 mos	4.78 (0.58)	0.993	3.73 (0.58)	3.59 (0.49)	3.74 (0.47)	0.193
48 mos	4.89 (0.99)	0.775	3.63 (0.52)	3.59 (0.51)	3.68 (0.40)	0.633
60 mos	5.13 (0.89)	0.275	3.58 (0.59)	3.48 (0.49)	3.58 (0.46)	0.448
Final visit	5.01 (0.59)	0.264	3.58 (0.59)	3.48 (0.49)	3.58 (0.46)	0.448
Accommodation, D, mean (SD)						
Screening	17.29 (3.24)	0.041	15.99 (3.15)	16.83 (2.72)	15.93 (2.76)	0.149
24 mos	16.68 (4.01)	<0.001	11.95 (2.72)	7.52 (2.58)	4.55 (2.16)	<0.001
36 mos	12.55 (2.49)	0.001	11.95 (2.72)	7.52 (2.58)	4.55 (2.16)	<0.001
48 mos	11.37 (3.21)	0.001	11.95 (2.72)	7.52 (2.58)	4.55 (2.16)	<0.001
60 mos	11.01 (3.20)	0.001	11.95 (2.72)	7.52 (2.58)	4.55 (2.16)	<0.001
Final visit	15.44 (2.48)	0.001	11.95 (2.72)	7.52 (2.58)	4.55 (2.16)	<0.001
Visual acuity, logMAR, mean (SD)						
Screening	0.07	0.059	0.03 (0.06)	0.02 (0.07)	0.02 (0.06)	0.440
24 mos	0.16	<0.001	0.01 (0.07)	0.07 (0.12)	0.27 (0.22)	<0.001
36 mos	0.06	0.434	-0.02 (0.05)	-0.02 (0.06)	-0.02 (0.06)	0.676
48 mos	0.07	0.728	-0.01 (0.05)	-0.02 (0.06)	-0.03 (0.06)	0.049
60 mos	0.07	0.535	-0.02 (0.05)	-0.02 (0.06)	-0.04 (0.05)	0.191
Final visit	0.06	0.451	-0.02 (0.05)	-0.02 (0.06)	-0.04 (0.05)	0.191

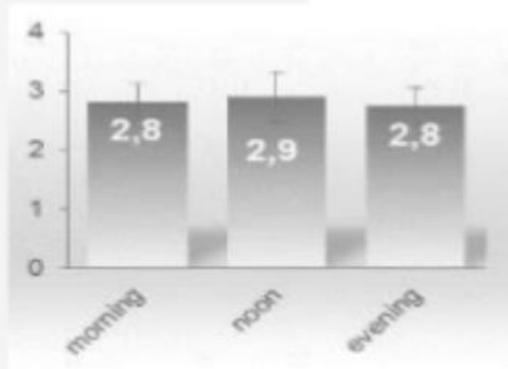
(Table 4). On restarting atropine 0.01%, there was a mean increase in photopic pupil size of approximately 1 mm and a loss of accommodation of 2.00 to 3.00 D, which were similar to the change noted in eyes treated with atropine 0.01% during phase 1 (Table 4). These mild side effects were deemed clinically insignificant, because there was no change or loss in distance or near visual acuity. Children were offered progressive addition spectacles (6 to 8 D) if the accommodation loss was significant.

What means “Less side effects” ?

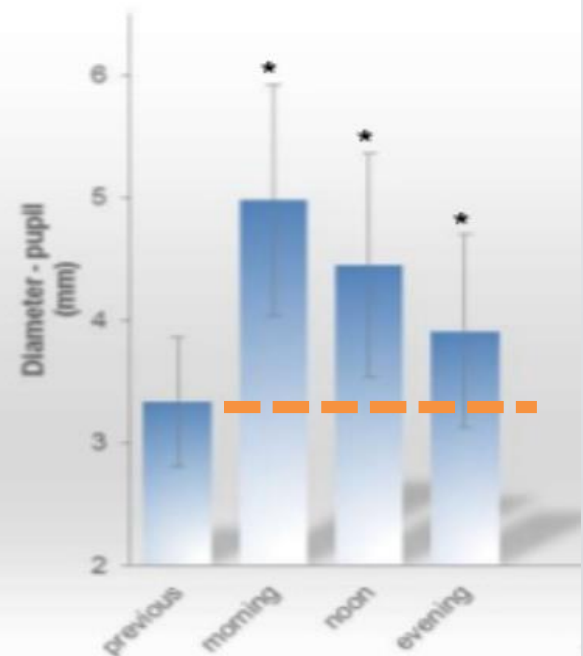
Atropin – kurzfristige Veränderungen (1) Pupillenweite

photopic

Control



0,01%



3.2mm -> 4.5mm = 40% grösser
10.24mm² -> 20.25mm² = 98% grösser

The Synergistic Effects of Orthokeratology and Atropine in Slowing the Progression of Myopia

Table 2. The effect of 0.125% and 0.025% atropine on orthokeratology (OK)-treated patients with spherical equivalent ≥ 6 D.

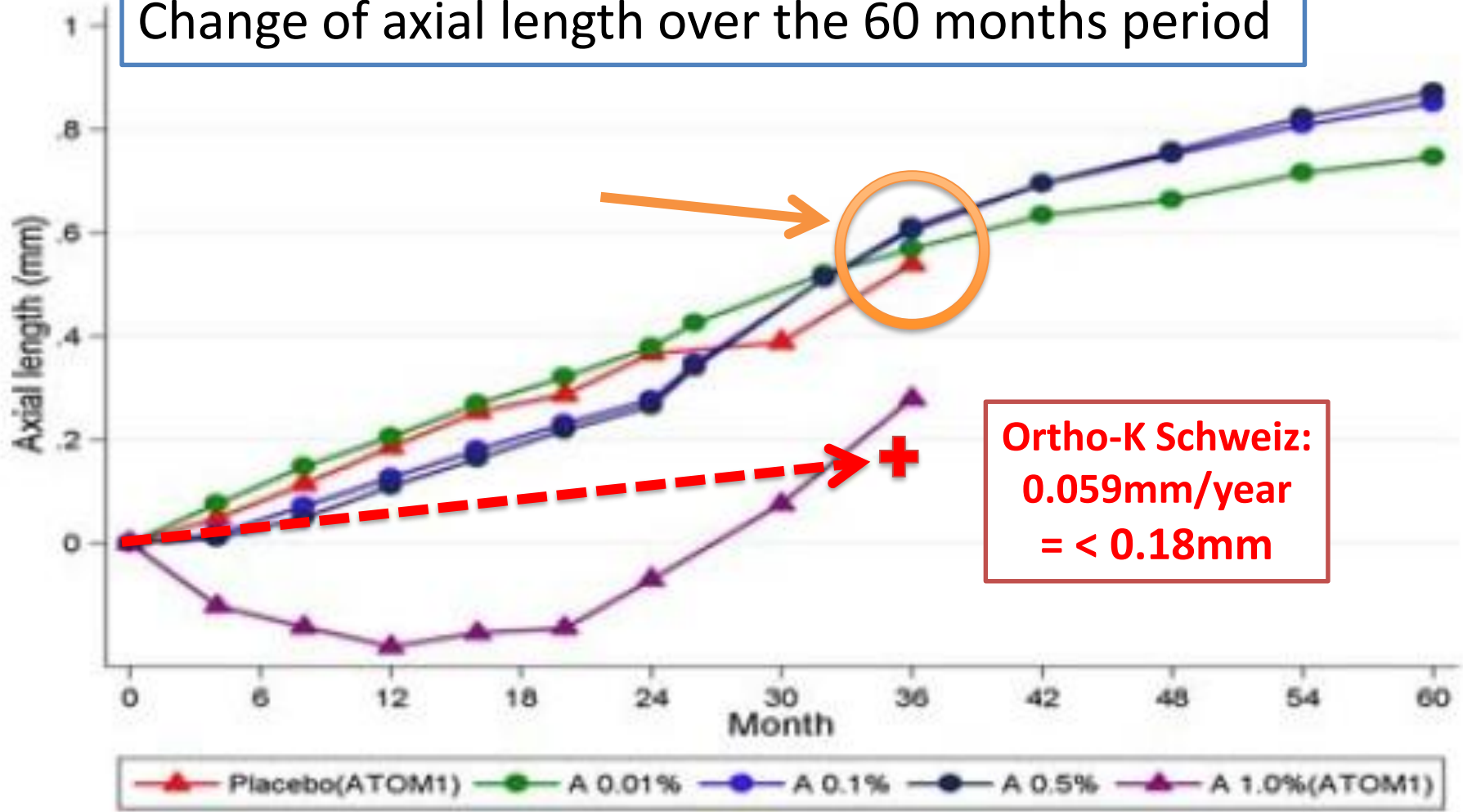
	Atropine (0.125%)		<i>p</i> -Value	Atropine (0.025%)		<i>p</i> -Value
	Yes (OA3) (N = 24)	No (OK3) (N = 29)		Yes (OA4) (N = 20)	No (OK4) (N = 20)	
Age	11.0 $\pm$ 1.8	10.8 $\pm$ 1.8	>0.05	10.8 $\pm$ 1.2	10.9 $\pm$ 1.3	>0.05
Female: male #	1:1	1.07:1		1:1	1:1	
Axial length (mm)						
Baseline	25.21 $\pm$ 1.35	25.29 $\pm$ 1.78	>0.05	25.28 $\pm$ 1.53	25.65 $\pm$ 1.67	>0.05
2 years	25.78 $\pm$ 1.46	25.93 $\pm$ 1.94	0.021	25.86 $\pm$ 1.21	26.05 $\pm$ 1.57	0.011
Difference in axial length	0.57 $\pm$ 0.17	0.64 $\pm$ 0.14	0.015	0.58 $\pm$ 0.08	0.4 $\pm$ 0.15	0.023
Spherical equivalent (D)						
Baseline	6.75 $\pm$ 1.5	6.75 $\pm$ 1.5	>0.05	6.63 $\pm$ 1.56	6.67 $\pm$ 1.73	>0.05
2 years	7.0 $\pm$ 0.5	7.2 $\pm$ 0.75	0.028	7.12 $\pm$ 1.83	7.32 $\pm$ 1.87	0.027
Photopic pupil diameter						
Baseline	3.9 $\pm$ 0.5	3.8 $\pm$ 0.7	>0.05	3.8 $\pm$ 0.57	3.6 $\pm$ 0.63	>0.05
2 years	6.6 $\pm$ 0.4	3.5 $\pm$ 0.6	<0.001	6.0 $\pm$ 0.7	3.7 $\pm$ 0.5	<0.001
Mesopic pupil diameter						
Baseline	4.8 $\pm$ 0.6	4.5 $\pm$ 0.7	>0.05	4.8 $\pm$ 0.5	4.7 $\pm$ 0.6	>0.05
2 years	6.9 $\pm$ 0.6	4.5 $\pm$ 0.8	<0.001	6.8 $\pm$ 0.6	4.8 $\pm$ 0.5	<0.001

- Significant increase of pupil size with Atropine: 206% to 286%

Atropine (1% vs 0.5% vs 0.1% vs 0.01%)

ATOM 2 Study

Change of axial length over the 60 months period

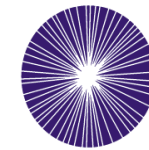


Atropine (1% vs 0.5% vs 0.1% vs 0.01%)

ATOM 2 Study

A Review of Current Concepts of the Etiology and Treatment of Myopia

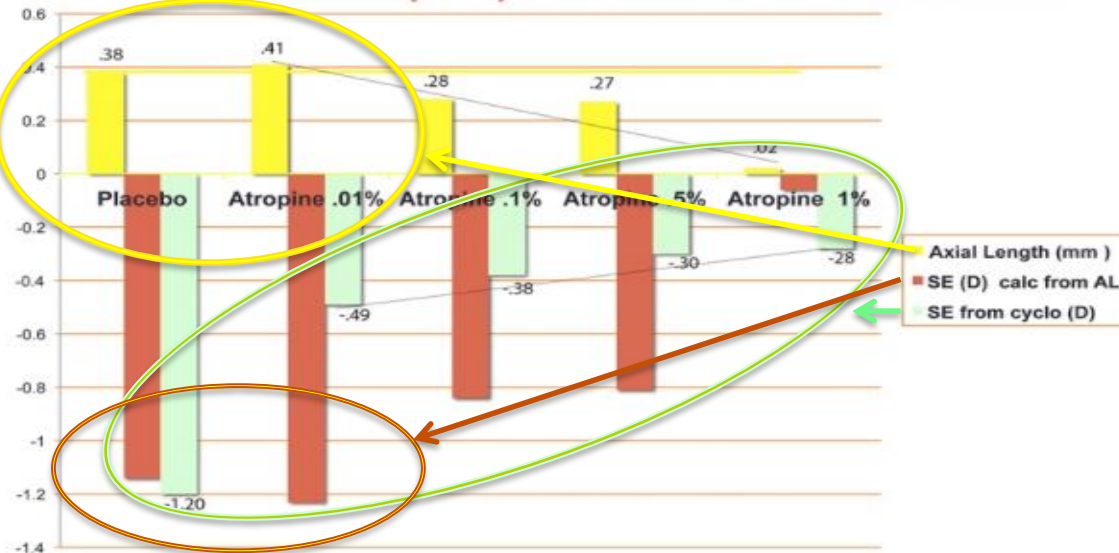
Jeffrey Cooper, M.S., O.D., F.A.A.O. and Andrei V. Tkatchenko, M.D., Ph.D.



AMERICAN ACADEMY
OF OPHTHALMOLOGY®

FIG. 10.

Changes in Axial Length and Spherical Equivalent (SE) Over 2 Years of Time



Changes in AL and SPH EQ after 2 years of treatment. Figure 10 depicts the changes in axial length in millimeters (yellow bars going up); spherical equivalent in diopters calculated from the

derived from the ATOM 1 study for atropine 1% and placebo and ATOM 2 for atropine 0.01%, 0.1%, and 0.5%, respectively. It is readily apparent that there is no real difference between axial length measurements after 24 months between placebo and atropine 0.01%; moderate changes with atropine 0.1% and 0.5%; and dramatic changes with atropine 1% (yellow bars). However, the effect of atropine 0.01% and atropine 1% is not nearly as great as the concentration differences.

What do we learn ?

Dosis, Dosis, Dosis !

Reduction of myopia progression (SE)

$\neq$

Reduction of axial length grow (AL)

Atropine 0.05% vs 0.025% vs 0.01% (LAMP Study)



AMERICAN ACADEMY
OF OPHTHALMOLOGY®

Ophthalmology Volume 126, Number 1, January 2019

Low-Concentration Atropine for Myopia Progression (LAMP) Study

A Randomized, Double-Blinded, Placebo-Controlled Trial of 0.05%, 0.025%, and 0.01% Atropine Eye Drops in Myopia Control

Jason C. Yam, FCOphthHK, FRCS(Edin),¹ Yuning Jiang, MMED,¹ Shu Min Tang, PhD,¹
Antony K.P. Law, MSc,¹ Joyce J. Chan, MRCSEd(Ophth),¹ Emily Wong, MBChB, MRCS(Edin),¹
Simon T. Ko, FCOphthHK, FHKAM(Oph),² Alvin L. Young, MMedSc(Hons), FRCOphth,^{1,3}
Clement C. Tham, FCOphthHK, FRCOphth,¹ Li Jia Chen, MRCSEd(Ophth), PhD,^{1,3} Chi Pui Pang, DPhil¹

Atropine 0.05% vs 0.025% vs 0.01% (LAMP Study)

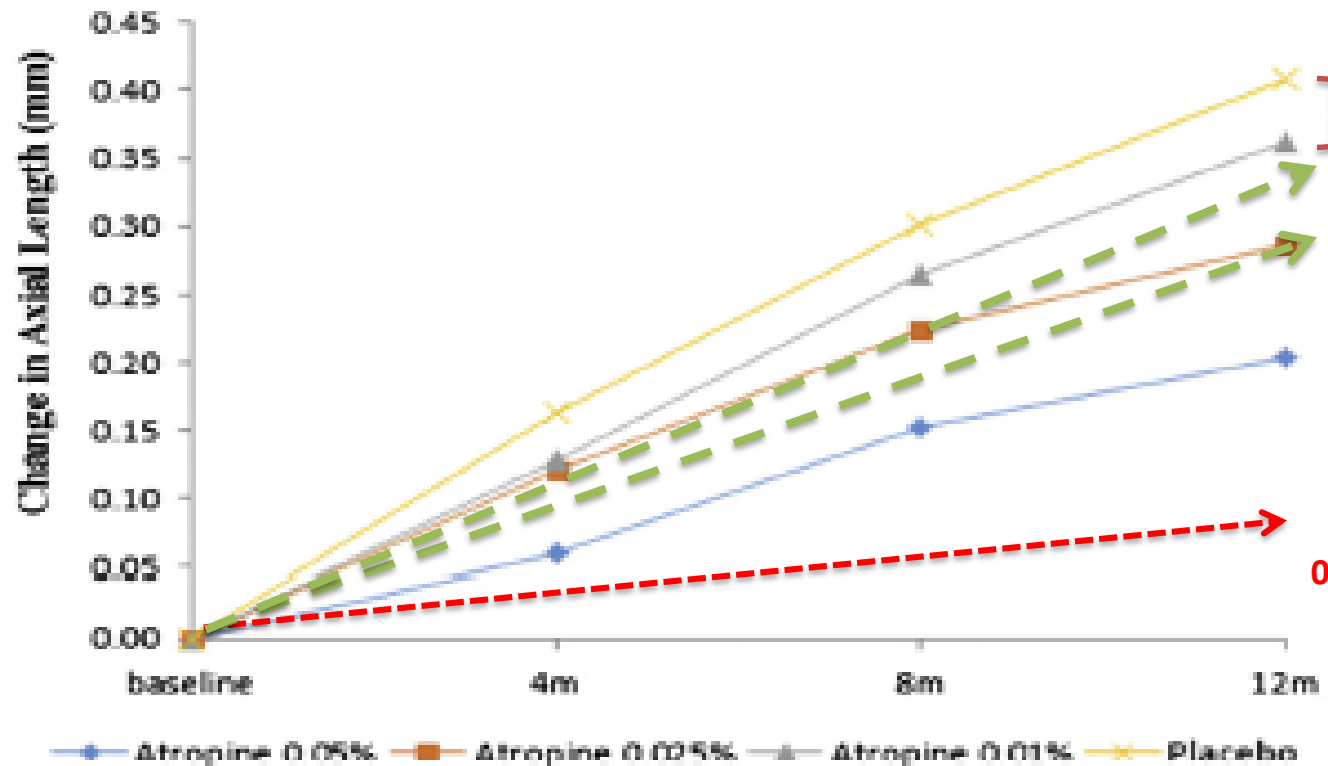


Figure 3. Change in axial length (AL) in treatment groups across time. m = month.

Wu et al:
0.28-
0.33mm/y
ear

Ortho-K
Schweiz:
0.059mm/year

It should be noted that the difference of AL changes between the 0.01% atropine and placebo groups in our study also was not significant, which was consistent with the AL results of ATOM 2. The efficacy of 0.01% atropine in ATOM 2 was primarily based on the reduction in myopia progression and only 12% in total elongation.

Ortho-Keratology and Safety

AMERICAN JOURNAL
OF OPHTHALMOLOGY®

Myopia Control in Children through Refractive Therapy Gas Permeable Contact Lenses: Is it for Real?

[Bruce H. Koffler](#) , [James J. Sears](#)

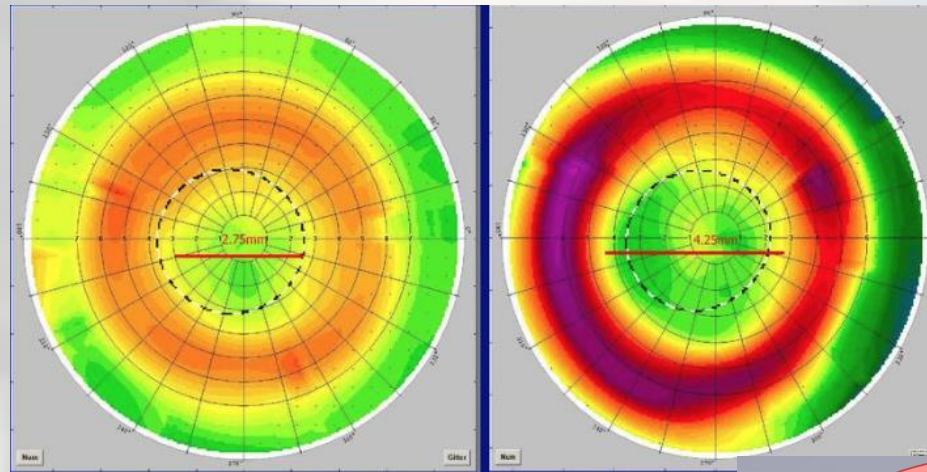
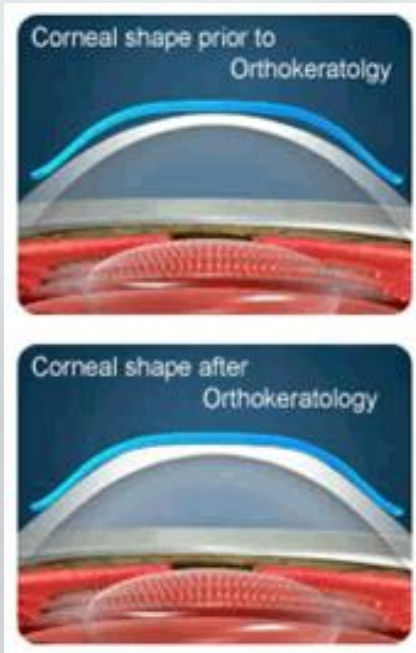
[Am J Ophthalmol.](#) 2013 Dec;156(6):1076-1081.e1. doi: 10.1016/j.ajo.2013.04.039.

Conclusions

Studies show that the use of orthokeratology is a safe and efficacious nonsurgical treatment for myopia and that it is capable of slowing axial elongation, making it an effective myopic treatment for children.

Ortho-Keratology

Controlled corneal topographical reformation to correct ammetropia temporarily



Safety and efficacy following 10-years of overnight orthokeratology for myopia control

Takahiro Hiraoka¹ , Yasuo Sekine², Fumiki Okamoto¹, Toshifumi Mihashi¹ and Tetsuro Oshika¹

¹Faculty of Medicine, Department of Ophthalmology, University of Tsukuba, Ibaraki, and ²Kashiwa Eye Clinic, Chiba, Japan

Citation information: Hiraoka T, Sekine Y, Okamoto F, Mihashi T & Oshika T. Safety and efficacy following 10-years of overnight orthokeratology for myopia control. *Ophthalmic Physiol Opt* 2018; 38: 281–289. <https://doi.org/10.1111/opo.12460>

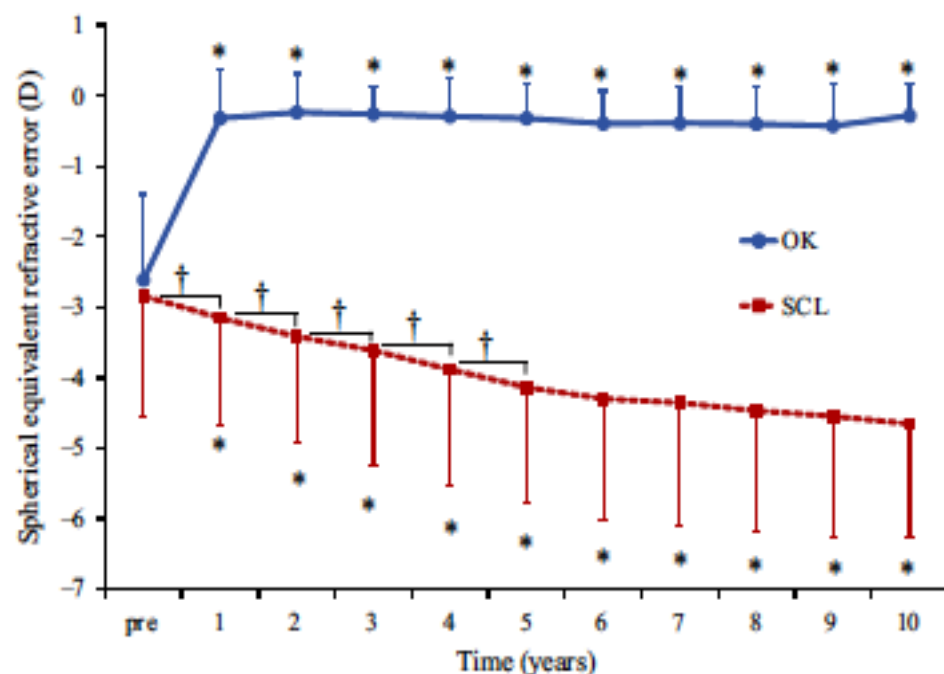


Figure 1. Changes over time in manifest refraction for the OK and SCL groups. OK, orthokeratology; SCL, soft contact lens. *Statistically significant differences compared to the baseline value by the Bonferroni post-hoc test. #Statistically significant differences between successive years by the Bonferroni post-hoc test.

In conclusion, the present findings showed that OK treatment was effective in slowing myopia progression over a 10-year treatment period and demonstrated a clinically acceptable safety profile among patients between the ages of 8 and 16 years. Patients undergoing OK treatment do not need to wear any vision-correction aids during day-

Ophthalmologe

<https://doi.org/10.1007/s00347-019-0874-6>

© Springer Medizin Verlag GmbH, ein Teil von Springer Nature 2019



Berufsverband der Augenärzte Deutschlands e. V. (BVA)¹ · Deutsche Ophthalmologische Gesellschaft (DOG)²

¹Berufsverband der Augenärzte Deutschlands e. V., Düsseldorf, Deutschland

²Deutsche Ophthalmologische Gesellschaft, München, Deutschland

Empfehlungen bei progredienter Myopie im Kindes- und Jugendalter

Stellungnahme von DOG und BVA. Stand Dezember 2018

tes Atropin in einer Konzentration von 0,01 % die Myopieprogression signifikant mindert. Das Ausmaß der Progressionsminderung liegt bei bis zu 50 %. Das Si-

Vergleichbare progressionsmindernde Effekte von bis zu 50 % werden der Orthokeratologie nachgesagt [28–30].

Ortho-Keratology and MK !

AMERICAN JOURNAL
OF OPHTHALMOLOGY®

Orthokeratology-Associated Infectious Keratitis in a Tertiary Care Eye Hospital in Hong Kong

[Tommy C.Y. Chan](#), [Emmy Y.M. Li](#), [Victoria W.Y. Wong](#), [Vishal Jhanji](#)  

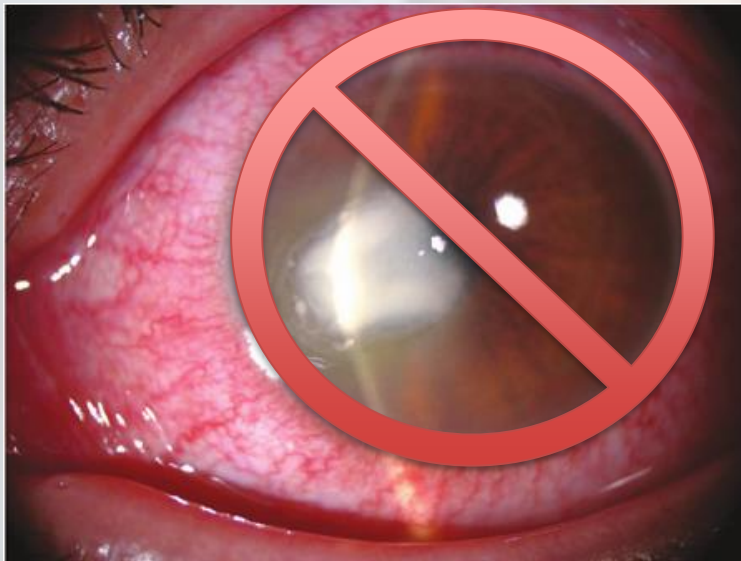
Hong Kong Eye Hospital, Hong Kong SAR, China; and Department of Ophthalmology & Visual Sciences, The Chinese University of Hong Kong, Hong Kong SAR, China

Am J Ophthalmol. 2014 Dec;158(6):1130-1135.e2. doi: 10.1016/j.ajo.2014.08.026. Epub 2014 Aug 23.

Infection. 2017 Dec;45(6):727-735. doi: 10.1007/s15010-017-1023-2. Epub 2017 May 22.

Infectious keratitis and orthokeratology lens use: a systematic review.

[Kam KW](#)^{1,2}, [Yung W](#)², [Li GKH](#)^{1,2}, [Chen LJ](#)^{1,2}, [Young AL](#)^{3,4}.



173 cases* (>85% by <2010)

Case reports and series 2002 – 2010/16

0.77 cases / 1'000 Px**

Optom Vis Sci. 2013 Sep;90(9):937-44. doi: 10.1097/OPX.0b013e31829cac92.

The risk of microbial keratitis with overnight corneal reshaping lenses.

[Bullimore MA](#)¹, [Sinnott LT](#), [Jones-Jordan LA](#).



ARTICLE

OPEN

Level of Compliance in Orthokeratology

Jiang Jun, M.D., Bian Zhiwen, M.D., Wang Feifu, M.D., O.D., Lian Lili, M.D., and Lu Fan, M.D., O.D.

Conclusions: The level of compliance with ortho-k lens wear in Mainland China is not high, necessitating ECPs to stress to patients the details of wear and care behaviors, especially avoiding exposing lenses to nonsterile solution. Improving monitoring of follow-up visits, particularly within the first 9 months of wearing ortho-k lenses, is needed.

Does Ortho-K fitting quality matters ?

China, July 2018

OK fitting rally, 5 clinics in 3 weeks

150-300 patients per day !



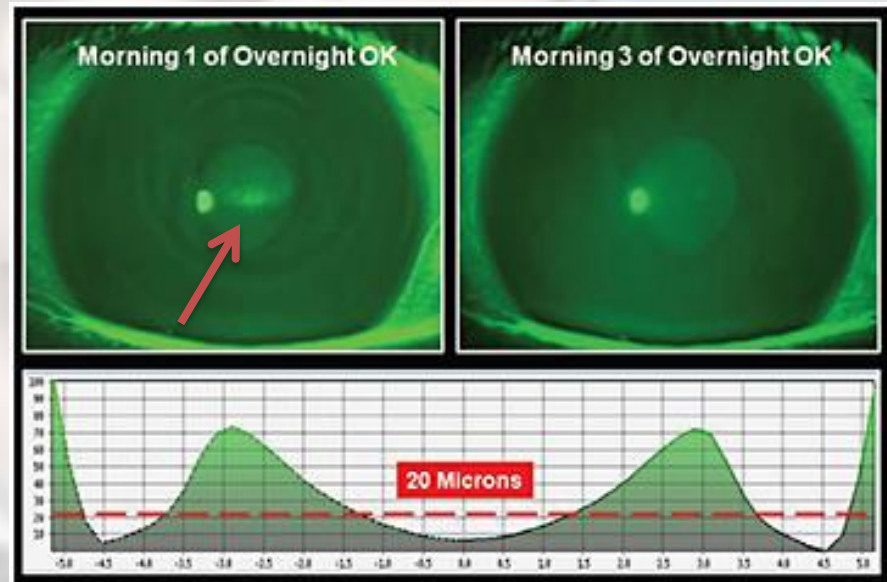
Refraktion und Kontaktlinsen

Dr. med. Albert Franceschetti

Präsident der Kontaktlinsenkommission der Schweizerischen Ophthalmologischen Gesellschaft, Meyrin



Myopie ist weltweit ein ernsthaftes Problem. Zwei Behandlungsmethoden gelten als wirksam. Bei weichen Kontaktlinsen gibt es drei Fehler, die es zu vermeiden gilt.



Schlaglicht der Schweizerischen Ophthalmologischen Gesellschaft

Refraktion und Kontaktlinsen

Dr. med. Albert Franceschetti

Präsident der Kontaktlinsenkommission der Schweizerischen Ophthalmologischen Gesellschaft, Meyrin



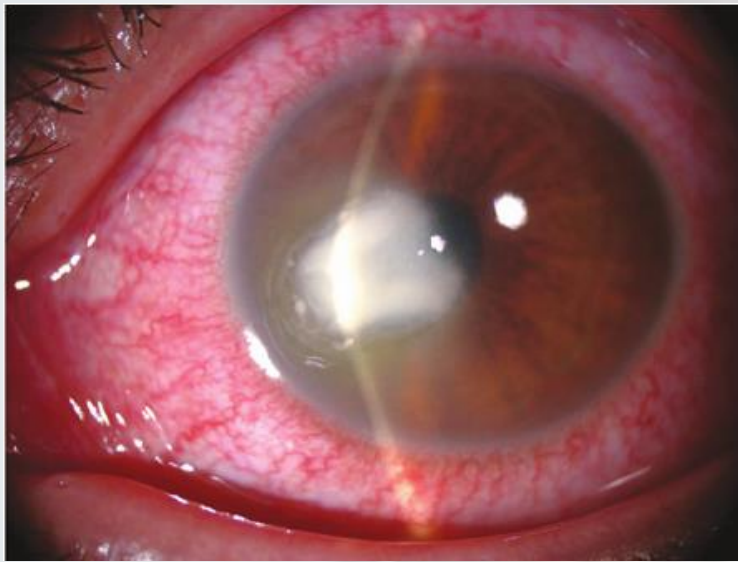
Myopie ist weltweit ein ernsthaftes Problem. Zwei Behandlungsmethoden gelten als wirksam. Bei weichen Kontaktlinsen gibt es drei Fehler, die es zu vermeiden gilt.



Albert Franceschetti

Orthokeratologie darf nur von Fachleuten durchgeführt werden. Bisher wird sie erst von wenigen Optometristen angewendet und ist kostenintensiv was ihre Anwendung begrenzt. Darüber hinaus besteht bei dieser Behandlungsform ein Infektionsrisiko. In orientalischen Ländern kam es häufig zu Infektionen, jedoch nur, weil dort die Hygieneregeln nicht korrekt befolgt wurden, und die Methode von Nichtfachleuten unsachgemäss angewendet wurde.

Bei uns hingegen werden die Hygienevorschriften im Allgemeinen beachtet und Anweisungen der Fachleute besser eingehalten. Überdies sind Optometristen, die diese Behandlungsmethode anbieten, seriöse Fachpersonen. Zudem verfügen die heutigen Kontaktlinsen über eine hohe Sauerstoffpermeabilität, wodurch die Hornhaut ausreichend mit Sauerstoff versorgt wird.



„Microbial Keratitis with Ortho-K“

0.77 cases / 1'000 Px

[Optom Vis Sci.](#) 2013 Sep;90(9):937-44. doi: 10.1097/OPX.0b013e31829cac92.

The risk of microbial keratitis with overnight corneal reshaping lenses.

[Bullimore MA¹](#), [Sinnott LT](#), [Jones-Jordan LA](#).



Figure 1 Acute-onset postoperative endophthalmitis (note the sutured corneal wound and hypopyon).

„Serious Adverse Events After

Cataract Surgery“

42.08 cases / 1'000 Px



NIH Public Access

Author Manuscript

Curr Opin Ophthalmol. Author manuscript; available in PMC 2013 September 19.

Published in final edited form as:

Curr Opin Ophthalmol. 2012 May ; 23(3): 219–225. doi:10.1097/ICU.0b013e31823524068.

Serious Adverse Events After Cataract Surgery

Joshua D. Stein, MD, MS

Department of Ophthalmology and Visual Sciences, University of Michigan Medical School

Clinical Ophthalmology

Open Access Full Text Article

Endophthalmitis: state of the art

This article was published in the following Dove Press journal:
Clinical Ophthalmology
8 January 2015
Number of times this article has been viewed

Kamyar Vaziri
Stephen G Schwartz
Krishna Kishor
Harry W Flynn Jr
Department of Ophthalmology,
Bascom Palmer Eye Institute,
University of Miami Miller School
of Medicine, Miami, FL, USA

Safety and efficacy following 10-years of overnight orthokeratology for myopia control

Takahiro Hiraoka¹ , Yasuo Sekine², Fumiki Okamoto¹, Toshifumi Mihashi¹ and Tetsuro Oshika¹

¹Faculty of Medicine, Department of Ophthalmology, University of Tsukuba, Ibaraki, and ²Kashiwa Eye Clinic, Chiba, Japan

Citation information: Hiraoka T, Sekine Y, Okamoto F, Mihashi T & Oshika T. Safety and efficacy following 10-years of overnight orthokeratology for myopia control. *Ophthalmic Physiol Opt* 2018; 38: 281–289. <https://doi.org/10.1111/opo.12460>

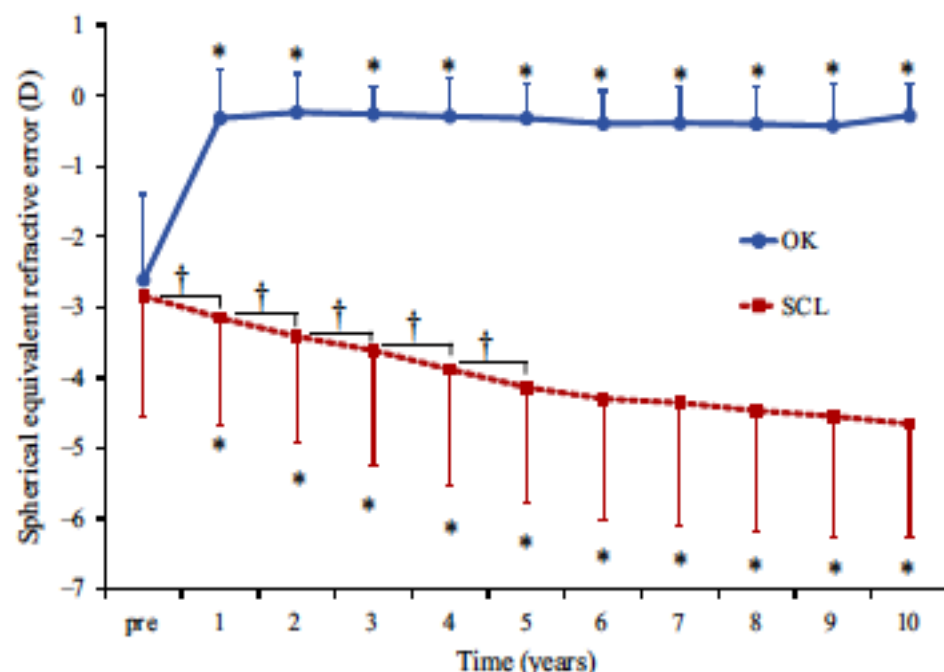


Figure 1. Changes over time in manifest refraction for the OK and SCL groups. OK, orthokeratology; SCL, soft contact lens. *Statistically significant differences compared to the baseline value by the Bonferroni post-hoc test. #Statistically significant differences between successive years by the Bonferroni post-hoc test.

In conclusion, the present findings showed that OK treatment was effective in slowing myopia progression over a 10-year treatment period and demonstrated a clinically acceptable safety profile among patients between the ages of 8 and 16 years. Patients undergoing OK treatment do not need to wear any vision-correction aids during day-

Effect of Orthokeratology on Axial Length Elongation in Anisomyopic Children.

Zhang Y¹, Chen Y.

TABLE 2. Axial length and axial length elongation in the anisomyopic orthokeratology group (mean/ $\pm$ SD)

	More myopic eyes (n = 49)	Less myopic eyes (n = 49)	P
Baseline axial length (mm)	25.33 $\pm$ 0.87	24.61 $\pm$ 0.86	<.0001
1-y axial length (mm)	25.36 $\pm$ 0.86	24.73 $\pm$ 0.84	<.0001
2-y axial length (mm)	25.42 $\pm$ 0.92	24.86 $\pm$ 0.89	<.0001
1-y axial elongation (mm)*	0.03	0.10	<.0001
2-y axial elongation (mm)*	0.08	0.20	.001

*Axial elongation data are presented as median values.

TABLE 4. Axial length and axial length elongation in the anisomyopic spectacle group (mean/ $\pm$ SD)

	More myopic eyes (n = 49)	Less myopic eyes (n = 49)	P
Baseline axial length (mm)	25.32 $\pm$ 0.75	24.59 $\pm$ 0.87	<.0001
1-y axial length (mm)	25.57 $\pm$ 0.83	24.83 $\pm$ 0.82	<.0001
2-y axial length (mm)	25.79 $\pm$ 0.90	25.01 $\pm$ 0.78	<.0001
1-y axial elongation (mm)*	0.24	0.22	.26
2-y axial elongation (mm)*	0.46	0.43	.32

*Axial elongation data are presented as median values.

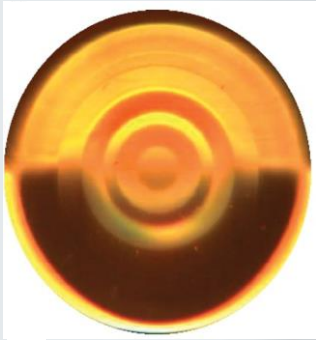
Ortho-Keratology

fifth ($P = 0.8633$) years. There were no severe complications throughout the study period.

CONCLUSIONS. The current 5-year follow-up study indicated that OK can suppress axial length elongation in childhood myopia. (*Invest Ophthalmol Vis Sci.* 2012;53:3913-3919) DOI: 10.1167/iovs.11-8453

- Safe and efficient (Hiraoka et al.: IOVS 2012)
- No CL or glasses during daytime
- No pupil size, pupil dynamics or accommodation change
- Maximum effect of all CL therapies on axial length growth inhibition
- Children are well suitable for Ortho-K

Soft daily disposable contact lens



MiSight (COOPER Vision) “Dual-Focus Lens”



Lloyd's Register
LRQA

EC CERTIFICATE – FULL QUALITY ASSURANCE SYSTEM

In accordance with the requirements of the Medical Devices
Directive 93/42/EEC and the Medical Devices Regulations 2002, UK
Statutory Instrument 2002 No. 618

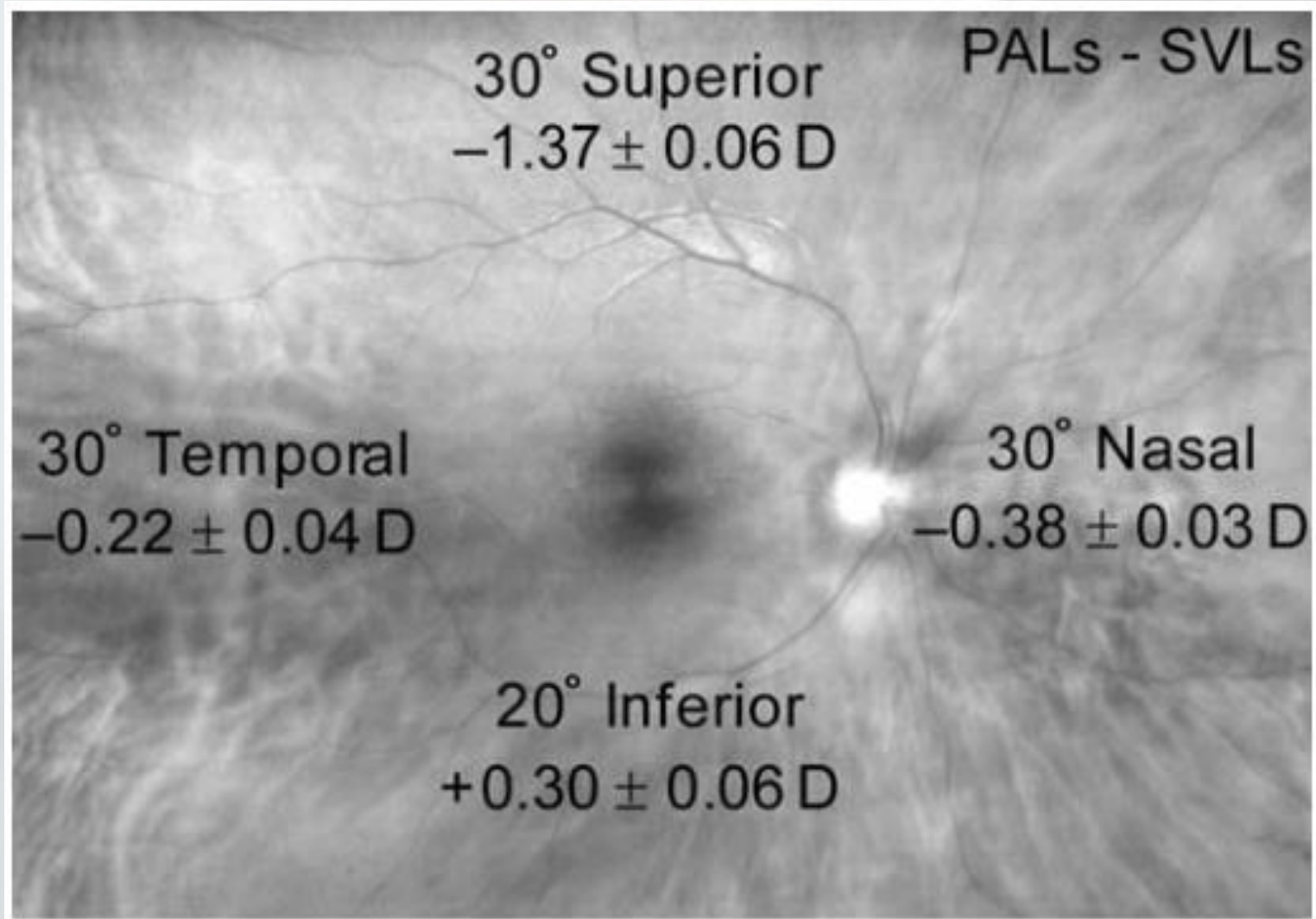
Soft (hydrophilic) contact lens products for the control of myopia:

Omafilcon A soft contact lens products for daily disposable wear

Somofilcon A soft contact lens products for daily disposable wear



Retinal Defocus mit PAL (Gleitsichtglas)



Atropine **AND** Contact Lenses

	Wirkungs- weise	Effekt nachge- wiesen	Einfachheit der Anwendung	Kosten	Medikam- entöse Nebenwi- rkungen	Optische Nebenwir- kungen	Rebound Effekt nach Absetzen	Zulassu- ng (zur chron. Anwend- ung)	Risiko	Eltern
Atropin 0.01% - 1%	Muscarin- antagonist	+ bis +/- Atropin 0.01% bis 0.05% ++ Atropin 0.5% bis 1%	++	++	+ ohne KS +/- mit KS (BAC !)	+/- Atropin 0.01% bis 0.05% - bis - - Atropin 0.5% bis 1%	+ Atropin 0.01% - bis - - Atropin 0.5% bis 1%	- (++) FDA evt. 2020	++ ohne KS	Chronische Medikamenten- gabe Unverträglich- keit
Kontakt- linsen	Korrektur des zentralen und peripheren Defokus	+ Ortho-K (+/-) MiSight +/- PDMCL	+ Ortho-K ++ MiSight + PDMCL	+/- Ortho-K + MiSight + PDMCL	+ Ortho-K (Peroxid) ++ MiSight + PDMCL (Peroxid)	+ Ortho-K + MiSight + PDMCL	- (14 jährig) + > 16 jährig	+ Ortho-K ++ MiSight - +/- PDMCL	+ Ortho-K ++ MiSight + PDMCL	Handhabung Kontaktlinse Sicherheit Kosten

Synergy: Atropin **AND** Contact Lens



Journal of
Clinical Medicine



Article

The Synergistic Effects of Orthokeratology and Atropine in Slowing the Progression of Myopia

Lei Wan ^{1,2,3,4,*} , Chang-Ching Wei ^{5,6} , Chih Sheng Chen ^{1,7}, Ching-Yao Chang ²,
Chao-Jen Lin ^{8,9}, Jamie Jiin-Yi Chen ¹⁰, Peng-Tai Tien ^{6,10,11} and Hui-Ju Lin ^{1,10,*} 

¹ School of Chinese Medicine, China Medical University, Taichung 404, Taiwan

² Department of Biotechnology, Asia University, Taichung 413, Taiwan; cychang@asia.edu.tw

³ Department of Obstetrics and Gynecology, China Medical University Hospital, Taichung 404, Taiwan

⁴ Research Center for Chinese Medicine & Acupuncture, China Medical University, Taichung 404, Taiwan

⁵ Children's Hospital, China Medical University Hospital, Taichung 404, Taiwan; weilonger@gmail.com

⁶ College of Medicine, China Medical University, Taichung 404, Taiwan; u702054@hotmail.com

⁷ Division of Chinese Medicine, Asia University Hospital, Taichung 413, Taiwan; pluto915@mail2000.com.tw

⁸ Department of Pediatrics, Changhua Christian Children's Hospital, Changhua 500, Taiwan;
124140@cch.org.tw

⁹ School of Medicine, Chung Shan Medical University, Taichung 402, Taiwan

¹⁰ Department of Ophthalmology, China Medical University Hospital, Taichung 404, Taiwan;
jane.editing@gmail.com

¹¹ Graduate Institute of Clinical Medical Science, China Medical University, Taichung 404, Taiwan

* Correspondence: leiwan@mail.cmuh.edu.tw or lei.joseph@gmail.com (L.W.);
d2396@mail.cmuh.org.tw (H.-J.L.); Tel.: +886-(0)4-22053366 (ext. 3326) (L.W.);
+886-(0)4-22053366 (ext. 3326) (H.-J.L.)

Received: 3 August 2018; Accepted: 5 September 2018; Published: 7 September 2018



Synergy: Atropin **AND** Contact Lens

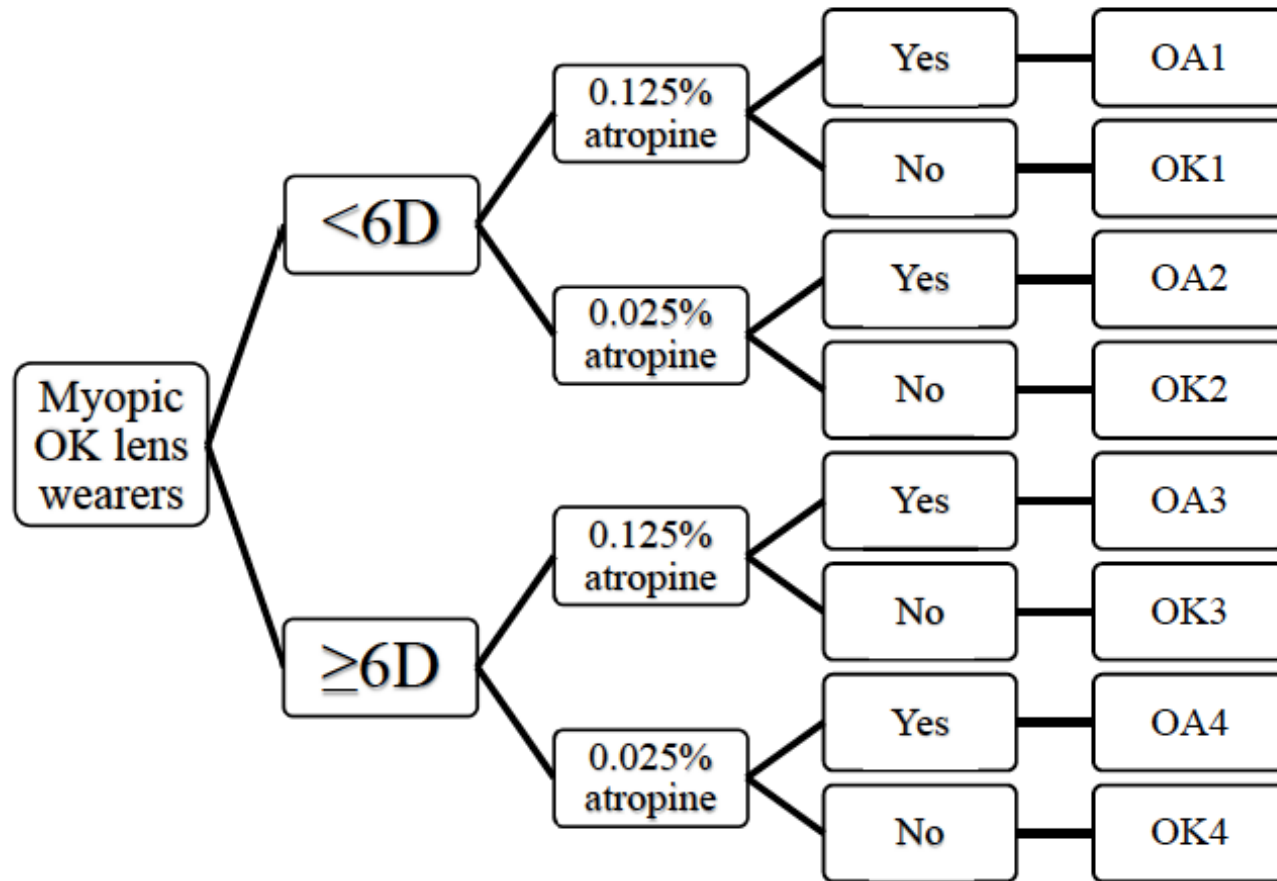


Figure 1. Treatments and groupings of subjects (OK—orthokeratology; OA—orthokeratology + atropine).

Synergy: Atropin **AND** Contact Lens

Table 1. The effect of 0.125% and 0.025% atropine on orthokeratology (OK)-treated patients with spherical equivalent <6 D.

	Atropine (0.125%)		<i>p</i> -Value	Atropine (0.025%)		<i>p</i> -Value
	Yes (OA1) (N = 20)	No (OK1) (N = 26)		Yes (OA2) (N = 20)	No (OK2) (N = 20)	
Age	10.6 ± 1.2	10.2 ± 1.7	>0.05	10.4 ± 1.3	10.3 ± 1.4	>0.05
Female: male #	1:1	1:1		1:1	1:1	
Axial length (mm)						
Baseline	24.12 ± 1.28	24.32 ± 1.53	>0.05	24.08 ± 1.31	24.19 ± 1.24	>0.05
 2 years	24.67 ± 1.53	24.7 ± 1.98	0.042	24.72 ± 1.53	25.01 ± 1.26	0.031
Difference in axial length	0.55 ± 0.12	0.58 ± 0.09	0.022	0.65 ± 0.18	0.83 ± 0.16	0.029
Spherical equivalent (D)						
Baseline	4.25 ± 1.75	4.25 ± 1.25	>0.05	4.53 ± 1.23	4.63 ± 1.35	>0.05
2 years	4.75 ± 0.75	4.8 ± 0.5	0.041	4.83 ± 1.12	5.13 ± 1.56	0.039
Accommodation						
Baseline	16.2 ± 3.1	16.7 ± 3.4	>0.05	16.3 ± 3.2	16.5 ± 3.4	>0.05
2 years	4.2 ± 2.7	16.3 ± 3.2	<0.001	4.6 ± 1.56	16.4 ± 3.2	<0.001

- Additional positive effect in 3 of 4 groups

Synergy: Atropin **AND** Contact Lens

Table 2. The effect of 0.125% and 0.025% atropine on orthokeratology (OK)-treated patients with spherical equivalent ≥ 6 D.

	Atropine (0.125%)		<i>p</i> -Value	Atropine (0.025%)		<i>p</i> -Value
	Yes (OA3) (N = 24)	No (OK3) (N = 29)		Yes (OA4) (N = 20)	No (OK4) (N = 20)	
Age	11.0 $\pm$ 1.8	10.8 $\pm$ 1.8	>0.05	10.8 $\pm$ 1.2	10.9 $\pm$ 1.3	>0.05
Female: male #	1:1	1.07:1		1:1	1:1	
Axial length (mm)						
Baseline	25.21 $\pm$ 1.35	25.29 $\pm$ 1.78	>0.05	25.28 $\pm$ 1.53	25.65 $\pm$ 1.67	>0.05
2 years	25.78 $\pm$ 1.46	25.93 $\pm$ 1.94	0.021	25.86 $\pm$ 1.21	26.03 $\pm$ 1.57	0.011
Difference in axial length	0.57 $\pm$ 0.17	0.64 $\pm$ 0.14	0.015	0.58 $\pm$ 0.08	0.4 $\pm$ 0.15	0.023
Spherical equivalent (D)						
Baseline	6.75 $\pm$ 1.5	6.75 $\pm$ 1.5	>0.05	6.63 $\pm$ 1.56	6.67 $\pm$ 1.73	>0.05
2 years	7.0 $\pm$ 0.5	7.2 $\pm$ 0.75	0.028	7.12 $\pm$ 1.83	7.32 $\pm$ 1.87	0.027
Accommodation						
Baseline	16.6 $\pm$ 2.9	16.8 $\pm$ 2.2	>0.05	16.6 $\pm$ 2.6	16.8 $\pm$ 2.1	>0.05
2 years	3.8 $\pm$ 2.9	15.9 $\pm$ 3.8	<0.001	3.9 $\pm$ 2.01	16.6 $\pm$ 2.9	<0.001

- Additional positive effect in 3 of 4 groups
- Significant reduction of accommodation from 16D to 4D

Synergy: Atropin **AND** Contact Lens

Table 2. The effect of 0.125% and 0.025% atropine on orthokeratology (OK)-treated patients with spherical equivalent ≥ 6 D.

	Atropine (0.125%)		<i>p</i> -Value	Atropine (0.025%)		<i>p</i> -Value
	Yes (OA3) (N = 24)	No (OK3) (N = 29)		Yes (OA4) (N = 20)	No (OK4) (N = 20)	
Age	11.0 $\pm$ 1.8	10.8 $\pm$ 1.8	>0.05	10.8 $\pm$ 1.2	10.9 $\pm$ 1.3	>0.05
Female: male #	1:1	1.07:1		1:1	1:1	
Axial length (mm)						
Baseline	25.21 $\pm$ 1.35	25.29 $\pm$ 1.78	>0.05	25.28 $\pm$ 1.53	25.65 $\pm$ 1.67	>0.05
2 years	25.78 $\pm$ 1.46	25.93 $\pm$ 1.94	0.021	25.86 $\pm$ 1.21	26.05 $\pm$ 1.57	0.011
Difference in axial length	0.57 $\pm$ 0.17	0.64 $\pm$ 0.14	0.015	0.58 $\pm$ 0.08	0.4 $\pm$ 0.15	0.023
Spherical equivalent (D)						
Baseline	6.75 $\pm$ 1.5	6.75 $\pm$ 1.5	>0.05	6.63 $\pm$ 1.56	6.67 $\pm$ 1.73	>0.05
2 years	7.0 $\pm$ 0.5	7.2 $\pm$ 0.75	0.028	7.12 $\pm$ 1.83	7.32 $\pm$ 1.87	0.027
Photopic pupil diameter						
Baseline	3.9 $\pm$ 0.5	3.8 $\pm$ 0.7	>0.05	3.8 $\pm$ 0.57	3.6 $\pm$ 0.63	>0.05
2 years	6.6 $\pm$ 0.4	3.5 $\pm$ 0.6	<0.001	6.0 $\pm$ 0.7	3.7 $\pm$ 0.5	<0.001
Mesopic pupil diameter						
Baseline	4.8 $\pm$ 0.6	4.5 $\pm$ 0.7	>0.05	4.8 $\pm$ 0.5	4.7 $\pm$ 0.6	>0.05
2 years	6.9 $\pm$ 0.6	4.5 $\pm$ 0.8	<0.001	6.8 $\pm$ 0.6	4.8 $\pm$ 0.5	<0.001

- Significant increase of pupil area with Atropine: + 135% to 256%

The Shelter-Principle in Myopia Management

Consequent aftercare and co-operation

Update
2019

+

+

Atropine
0.01-0.05%

Outdoor
Sunlight

Contact
Lenses

AGE e.g. 5 – 9+ yo

0 – >16 yo

e.g. 8 – >16 yo



Berufsverband der Augenärzte Deutschlands e. V. (BVA)¹ · Deutsche Ophthalmologische Gesellschaft (DOG)²

¹Berufsverband der Augenärzte Deutschlands e. V., Düsseldorf, Deutschland

²Deutsche Ophthalmologische Gesellschaft, München, Deutschland

Empfehlungen bei progredienter Myopie im Kindes- und Jugendalter

Stellungnahme von DOG und BVA. Stand Dezember 2018



Article

The Synergistic Effects of Orthokeratology and Atropine in Slowing the Progression of Myopia

Lei Wan ^{1,2,3,4,*}, Chang-Ching Wei ^{5,6}, Chih Sheng Chen ^{1,7}, Ching-Yao Chang ²,
Chao-Jen Lin ^{8,9}, Jamie Jiin-Yi Chen ¹⁰, Peng-Tai Tien ^{6,10,11} and Hui-Ju Lin ^{1,10,*}



A Review of Current Concepts of the Etiology and Treatment of Myopia

Jeffrey Cooper, M.S., O.D., F.A.A.O. and Andrei V. Tkatchenko, M.D., Ph.D.

Refraktion und Kontaktlinsen

Dr. med. Albert Franceschetti

Präsident der Kontaktlinsenkommission der Schweizerischen Ophthalmologischen Gesellschaft, Meyrin



Myopie ist weltweit ein ernsthaftes Problem. Zwei Behandlungsmethoden gelten als wirksam. Bei weichen Kontaktlinsen gibt es drei Fehler, die es zu vermeiden gilt.



Myopie-Progression: Aktueller Stand der Forschung

Michael Bartsch, Bern

Epidemiologie

Weltweit liegt die Prävalenz der Myopie bei 10–30% in Ozeanien, Afrika und Südamerika, bei 30–40% in Europa,

verbrachte Zeit^{14,18} oder Exposition bestimmter Wellenlängen^{16,19}, der refraktive Fehler (peripherer Defokus^{20,21} und Akkommodation/Konvergenz²²) und der Ausbildungsgrad.^{2,8}

In der Entwicklung/Erprobung befindliche refraktive oder visual-therapeutische Verfahren:
– Brillengläser (MyoSmart und MyoVision)

Single dose Atropine in CH ?

- **Bichsel Laboratorium Interlaken**

oder

- **TopPharm Apotheke Meyer Sursee**

What we learned so far

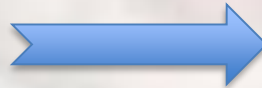
Myopia progression is :

- Multifactorial and strong related to age
- Potentially pathological for growing eyeballs
- Evidence based and clinically proven efficient strategies/therapies exist
- Sunlight works mainly during emmetropization phase, very weak correlation for inhibition in already myopic eyes
- Optimal sunlight/outdoors hours from 8 to 14
- Smart phones are less a risk
- **Combination of low dose Atropine and CL works the best**



Conclusion / Take Home

- Act EARLY / young and consequent !
- Inform child and parents neutral and evidence based
- Choose the right therapy depending the age, the actual myopia, the progression rate and the attitude of the parents and the child.
- **Adjust and combine strategies over time !**
- Co-operation of Ophthalmologist and Optometrist is evident



Herzlichen Dank

kontaklinsenstudio bärtschi PORTRAIT DIENSTLEISTUNGEN PRODUKTE NEWS KONTAKT K2 - THE DOUBLE

eyeness® wellness für ihre augen

SOCIAL MEDIA
EVENTS UND MEDIEN
DOWNLOADS
OFFENE STELLEN

DOWNLOADS

Wellness für ihre Augen - unser Leitgedanke. Wir geben Interviews, schreiben (Fach)Artikel oder stellen unsere Vision und Forschungsergebnisse an Vorträgen vor. Wir können nicht schweigen!

Hier haben wir für Sie alles zusammengestellt was sich so ansammelt an Vorträgen, Publikationen, Radiointerviews und Zeitungsbeiträgen.

Suchen nach Autor

	Weitsicht in Extremis, "die Kontaktlinse"	1.51 MB	20.12.2018
	OCT und Fundus Workshop, Mediconsult Academy	5.33 MB	15.10.2018
	Optometrie im Alltag - Tag der Optometrie, München	3.03 MB	14.10.2018
	Use of therapeutic contact lenses in Epidermolysis Bullosa Dystrophica, DEBRA Congress	1.75 MB	09.09.2018
	Orthokeratologie und Presbyopie - Artikel "die kontaktlinse"	109.45 KB	15.08.2018
	much more than perfect vision - M.Sc. Kurs Benediktbeuren DE	3.58 MB	09.06.2018
	Weiche torische Kontaktlinsen bei Astigmatismus - ein Fallbericht / die kontaktlinse	4.75 MB	22.05.2018
	Tangible Blues, DEFA, Ulmria Club	1.42 MB	12.03.2018

NEUES ENT

eyeness ag, Hirschengraben 11, CH-3011 Bern, Telefon +41 (31) 311 07 66, info@eyeness.ch

NOTFÄLLE [+ DOWNLOADS](#)

Dr. Michael Bärtschi

Ph.D. in Biomedicine (ARVO)

M.Sc.Optom. et M.med.Education (FAAO)

mbaertschi@eyeness.ch

www.eyeness.ch

Swiss Academy
of Ophthalmology



Luzern, 7. March 2019

Voting:

Will you practicing myopia management
in the future ?

- A. Yes, more than before
- B. Yes, but less than before
- C. No
- D. Uncertain