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Five important  
Questions to ask  
in Myopia Control

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Gudrun Bischoff, Udo Heuer  
Lübeck / Germany

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I have nothing to  
declare

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Any pictures of  
lenses or other

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products are only  
intended for

clarification of

# Congratulations to ECLSO for this excellent Scientific Program

Contact Lens & Cornea



IMCLC

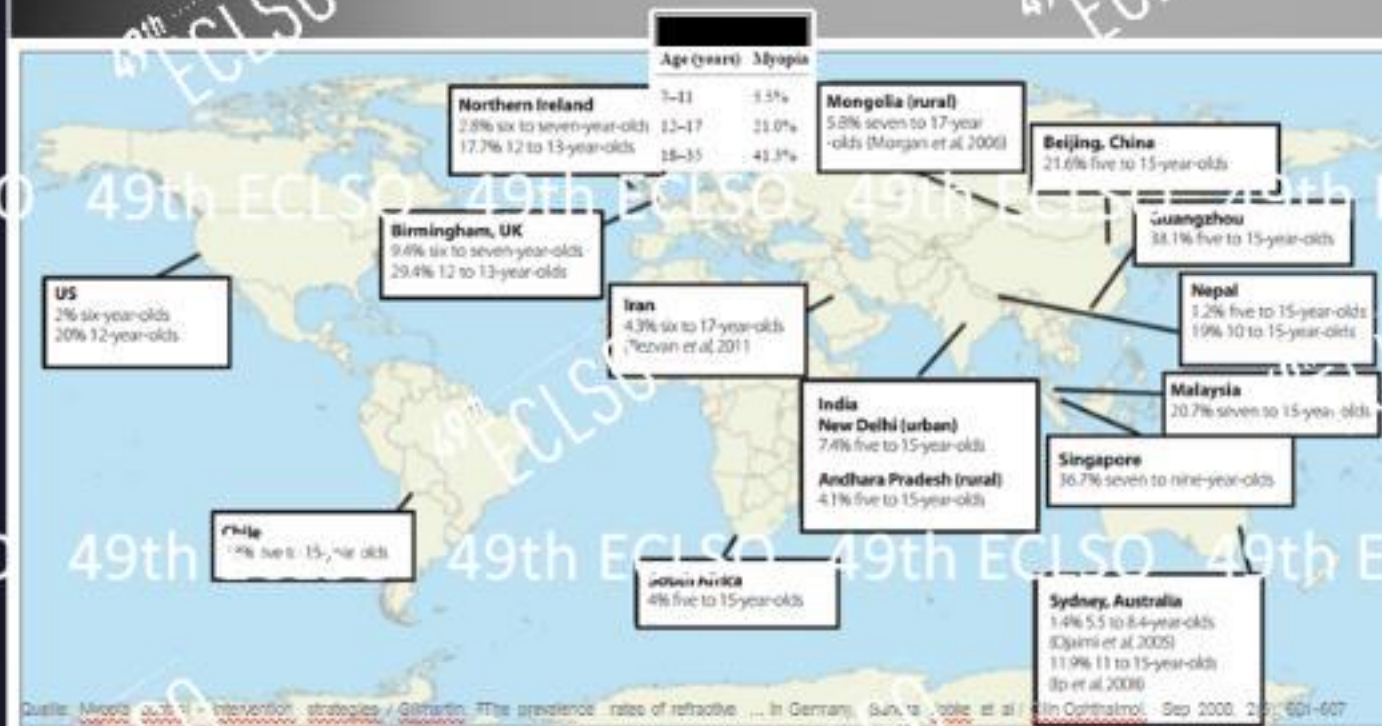
International Medical Contact Lens Council

President Prof. Dr. Akira Murakami - Japan

International Representative Dr. Bruce Koffer - USA

Executive Secretary General Dr. Gudrun Bischoff

49th ECLSO Myopia worldwide in children and teens



Quelle: Miopia, ocular intervention strategies / Gilmanin. The prevalence rates of refractive ... In Germany, Sun, et al. J Clin Ophthalmol. Sep 2008; 2(9): 601-607

# European Approach<sup>EJO</sup>

European  
Journal of  
Ophthalmology

## Update and guidance on management of myopia. European Society of Ophthalmology in cooperation with International Myopia Institute

European Journal of Ophthalmology  
2021, Vol. 31(3) 853-883  
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SAGE

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Ingrida Januleviciene<sup>7</sup>, Andrzej Grzybowski<sup>8,9</sup>,  
Zoltán Zsolt Nagy<sup>1</sup>, Olavi Pärssinen<sup>10</sup>, Jeremy A. Guggenheim<sup>11</sup>,  
Peter M. Allen<sup>12</sup>, Rigmor C. Baraas<sup>13</sup>, Kathryn J. Saunders<sup>14</sup>,  
Daniel Ian Flitcroft<sup>15,16</sup>, Lyle S. Gray<sup>17</sup>, Jan Roelof Polling<sup>18,19</sup>,  
Annechien EG Haarman<sup>18</sup>, J. Willem L. Tideman<sup>18</sup>,  
James Stuart Wolffsohn<sup>20</sup>, Siegfried Wahl<sup>21,22</sup>, Jeroen A. Mulder<sup>19</sup>,  
Irina Yurievna Smirnova<sup>23</sup>, Marino Formenti<sup>24</sup>,  
Hema Radhakrishnan<sup>25</sup> and Serge Resnikoff<sup>26,27</sup>

### Abstract

The prevalence of myopia is increasing extensively worldwide. The number of people with myopia in 2020 is predicted to be 2.6 billion globally, which is expected to rise up to 4.9 billion by 2050, unless preventive actions and interventions are taken. The number of individuals with high myopia is also increasing substantially and pathological myopia is predicted

# Auf in den Kampf gegen Myopie

## MiSight® 1 day

Die erste weiche Kontaktlinse, die das Fortschreiten der Kurzsichtigkeit bei Kindern nachweislich verlangsamt.<sup>1</sup>



Cooper  
Vision

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# 1. Diagnosis

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Eye-Care Professional

Eye Doctor / Ophthalmologist

Optometrist

Optician

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# Genetics – Role of Heredity

Genetics greatly influence the growth of the eye, but the correlation between the components of refraction for the eye to become emmetropic is affected by environmental factors such as education, metabolism, physical activity, and outdoor activity.

Cambridge Ophthalmological Symposium

*Eye* (2014) 28, 126–133; doi:10.1038/eye.2013.254; published online 20 December 2013

Genetic and environmental effects on myopia development and progression  
E Goldschmidt and N Jacobsen





# 1. Therapy

We cannot cure but reduce symptoms

Correction of refraction error

Prevention of myopia progression

Surgical treatment (not in children)

Pharmacological therapy

Combination CLS & Medication

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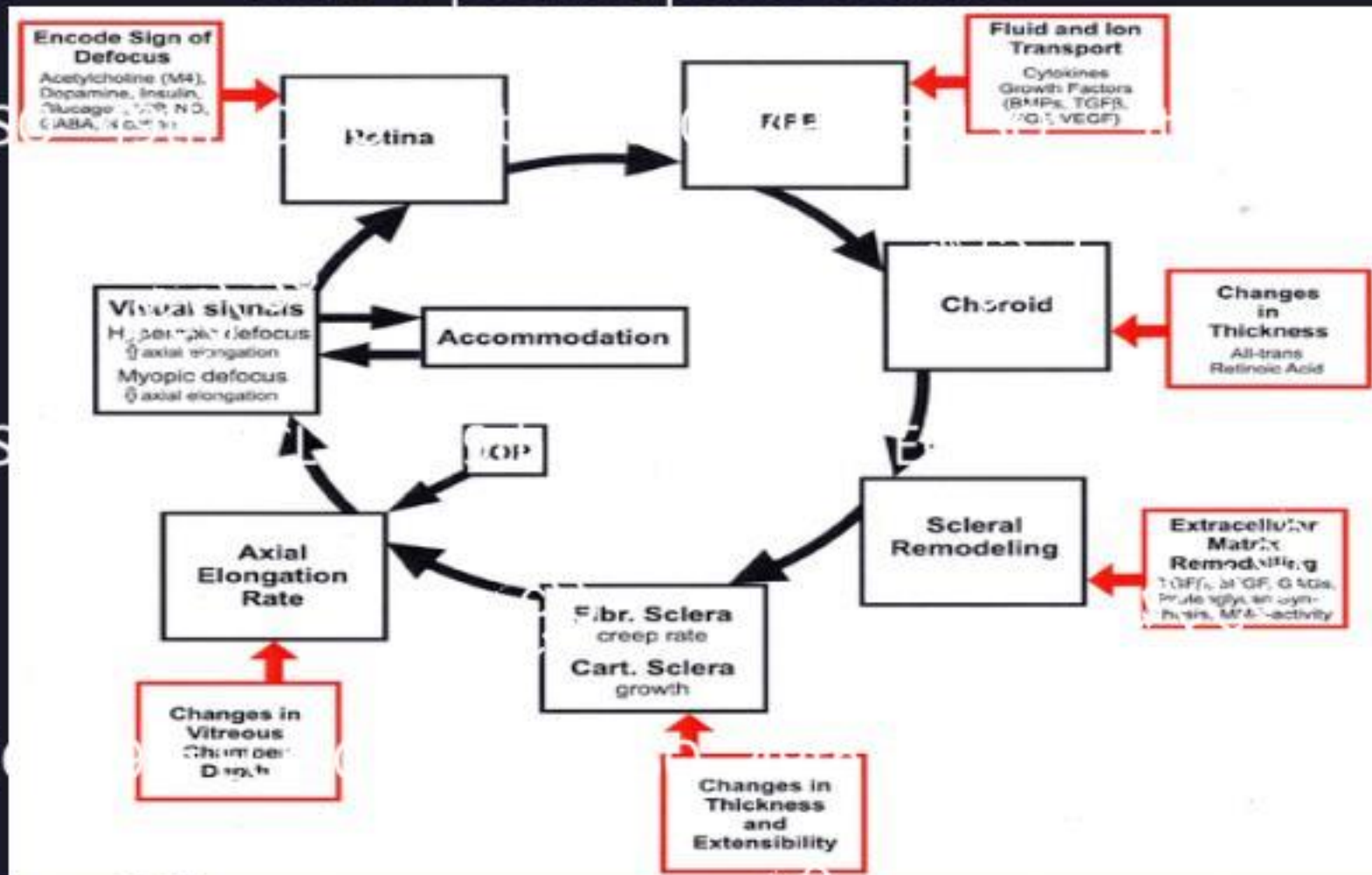
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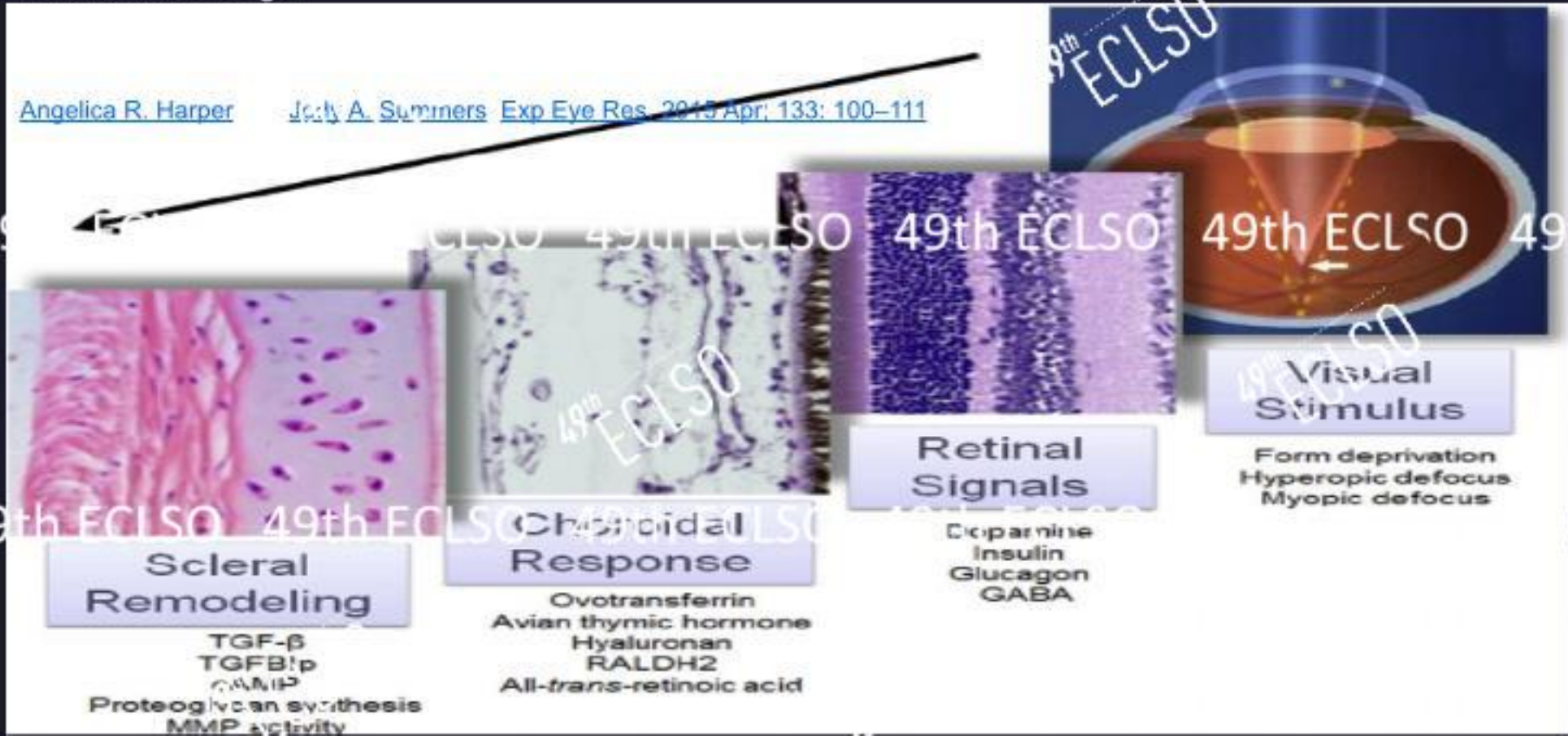


## Circle of possible points of action



**The retina-to-sclera signaling cascade.** In response to **visual stimuli such as form deprivation (blur), hyperopic defocus (minus lens treatment), or myopic defocus (plus lens treatment)**, changes in a variety of chemical substances have been documented in the retina/RPE, choroid and sclera (listed under each tissue). Although the relationships, if any, between these tissue specific substances have not been determined, it is likely that visual stimuli are transduced through the retina and choroid to ultimately affect **scleral matrix remodeling** and ocular axial length.

[Angelica R. Harper](#) [Jocely A. Summers](#) [Exp Eye Res. 2015 Apr; 133: 100-111](#)



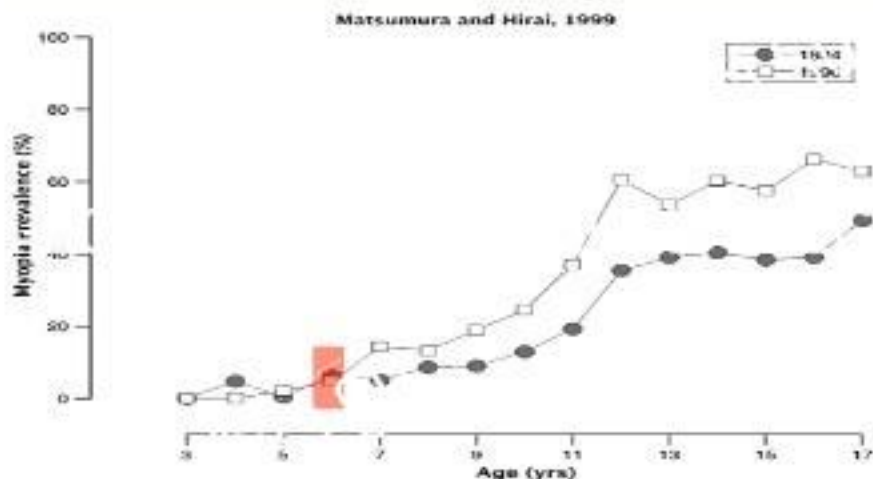
# Prevention

when necessary?

Wolfschlag JS, Pinteroft D, Gilford KL, et al. Myopia Control Reports Overview and Introduction. *Invest Ophthalmol Vis Sci.* 2019;60(3):M1-M19. doi:10.1167/lovs.18-25980

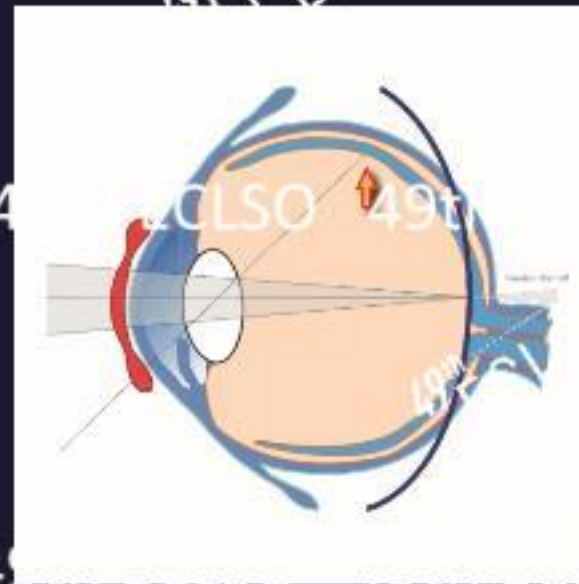
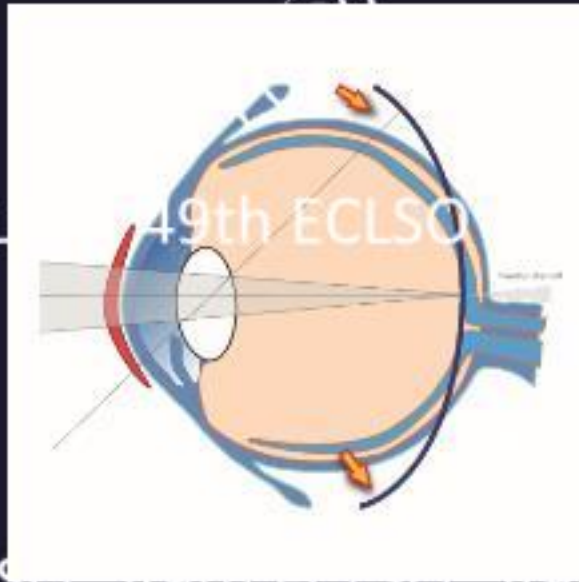
- In children younger than 6 years the prevalence of myopia is low
- most studies show a prevalence rate of myopia in the pre-6-year-old age group to be less than 5%

- The incidence of myopia increases dramatically in at-risk populations from approximately 6



Rise in myopia in children between 7 and 17 years of age in Japan between 1984 and 1996.

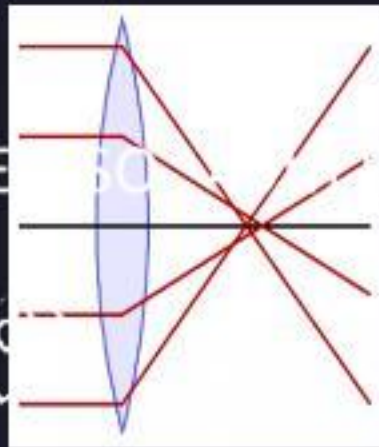
# To regard: peripheral focal plane Defocus Theory



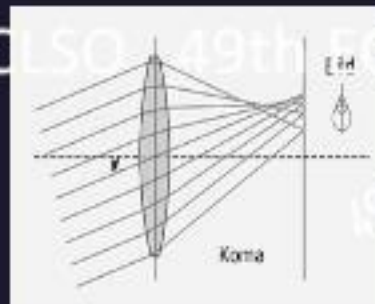
Visual signals relating to **retinal defocus** control the eye growth and guide emmetropization, and the refractive development of the eye.



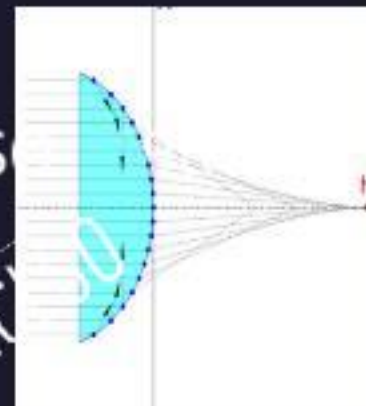
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Just a  
reminder  
optics



Sphärische  
Aberration



High-Order  
Aberration



sphärische Linse

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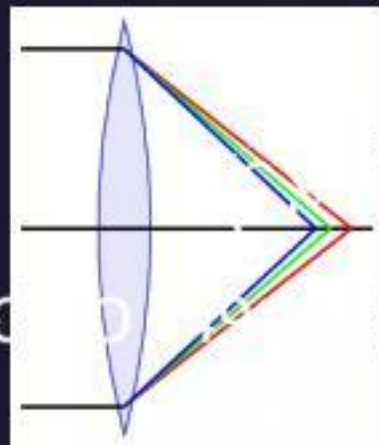
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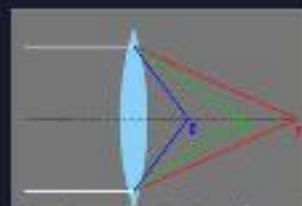
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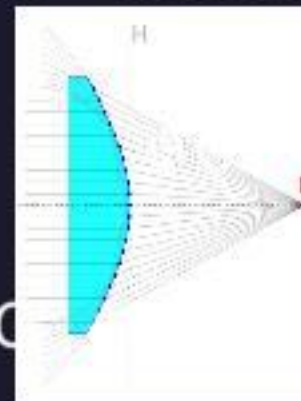
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Chromatische  
Aberration



Chromatische  
Aberration



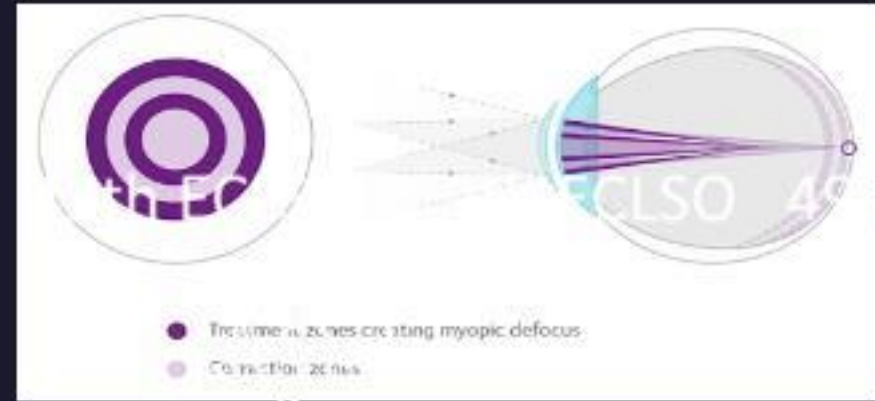
asphärische Linse

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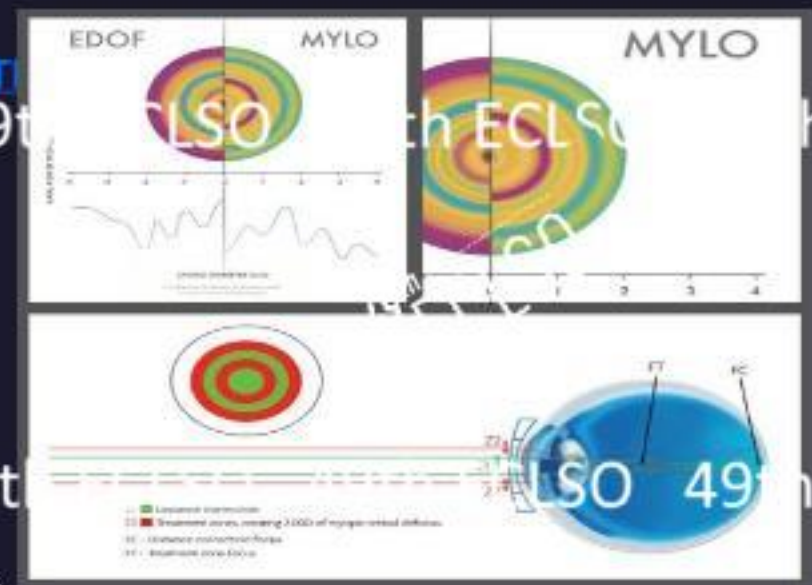
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Grafiken aus Wikipedia

# Contact Lenses

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 Multifocal Contact Lens  
 Dual-action zone lenses ([MiSight by Coopervision](#))



EDOF lenses ([Mylo by mark'ennovy](#) and [NaturalVue by VTI](#))  
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Distance-center focused design ([Biofinity ME CL by Coopervision](#))



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# Orthokeratology: How does OK work

- Classical design

- Pressing zone

- traction reverse zone

- Central reduction of intercellular gaps by moving of fluid



# Orthokeratology

Choo, Caroline *et al.*, 2004



# Squeezing a lemon to visualize OK effect



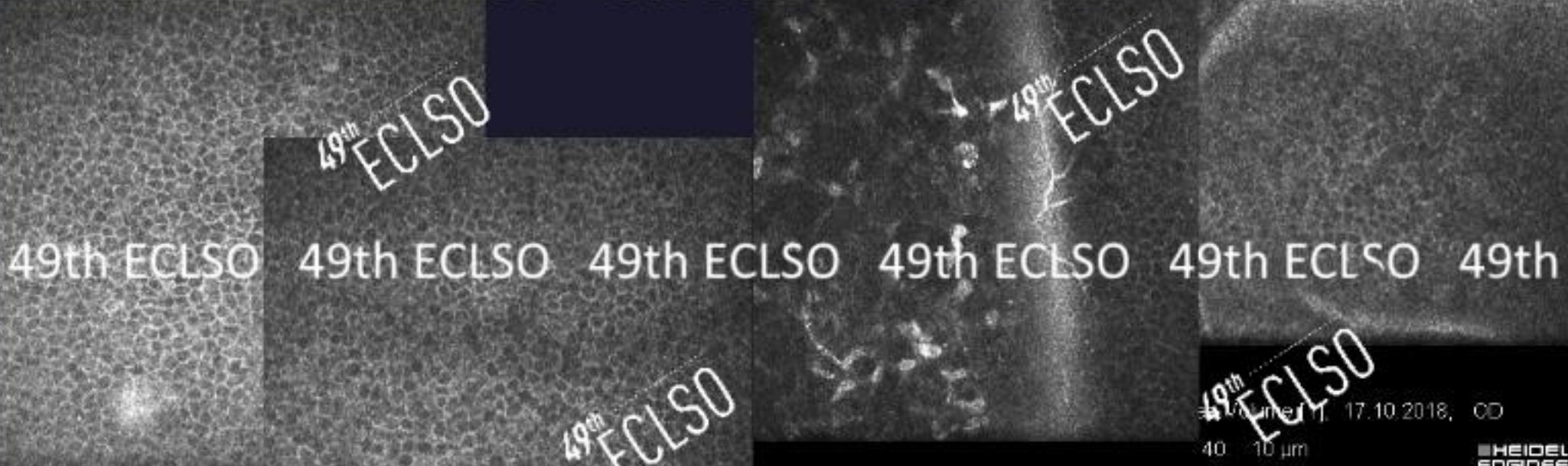
Pressing  
out fluid



Stiffening  
structures stay

# 2 years OK: Microstructure

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Cornea Volume [1], 17.10.2018, OD  
# 2 / 40: -8 µm

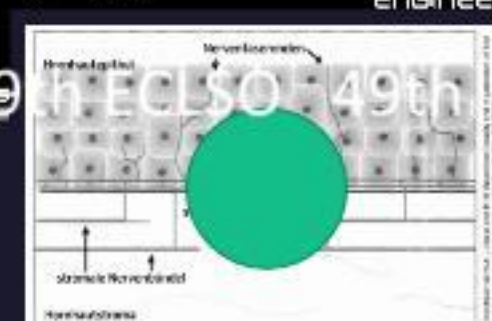
Density of cells

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Cornea Volume [1], 17.10.2018, OD  
# 6 / 40: 0 µm

Cornea Section [4], 17.10.2018, OS  
# 1 / 1: 0 µm

Somehow slightly irregular structures below Bowman



# Pharmakology Treatment

## • Starting with Atropine

- Atropine is a tropan-alkaloid (no uniform definition until now) from belladonna atropa. It inhibits competitive acetylcholine reaction with muscarinergerg rezeptores M<sub>1</sub> until M<sub>5</sub>.



# Low Dose Atropine 0.01%!!,

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what happens??

**Optical (side) effect? Changing the anatomical structure?**

## Effects of atropin 0.01%:

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- **Reduction of accommodation** in 6year old children from 16 to 14.8dptr. (= 2cm) (Fricke,A et al., DGII Handbook, 2016,201-205)

- **Dilation of the pupil** 1.3mm photopic and mesopic

- Monocular effect stays over 48 hours

- No difference between blue or brown eyes





# Accommodation, physiological

What happens?

- Changing refractive lens geometry. Moving peripheral focus in front of the retina.
- **Axial length progression 1: Thinning chorioid.** Blood vessels getting parasympathetic input during accommodation (Nickla and Wellmann 2010)
- **Axial length progression 2:** Stretching chorioid, dependent on contraction of ciliary body muscle during accommodation
- Axial length progression 3: Moving of sclera during accommodation (Harper and Summers)
- **Axial length progression 4:** diurnal variation, at noon maximum

# Control of Myopia by Dopamine

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Dopamine is a chemical intermediate in the biosynthesis of  
adrenaline (catecholamine), starting from the amino acid tyrosine.

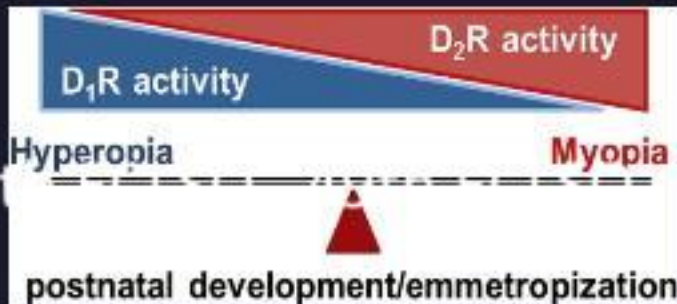
- Overview of dopamine, retinal function, and myopia 15<sup>th</sup> int. myopia conference  
P. Michael Iuvone (miuvone@pharm.emory.edu) Departments of Ophthalmology  
and Pharmacology, Emory University School of Medicine, Atlanta, GA, 30322, USA  
[ECLSO 2016; 3\(45-6\)](#) - 11, published online 2016 Nov 7.

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**Dopamine-deficient Parkinson, Restless legs, increasing Myopia**

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**Experiments over the last 10 years show that dopamine reduces the progression of myopia**

- Two dopamine receptor families: D1 and D2; The retina expresses 4 of the 5 DA; receptor  
subtypes: [D1R](#) and [D5R](#), [D2R](#) and [D4R](#),





### Dopamine receptor family:

A working hypothesis: Homeostatic control of myopia by opposing effects of D1-like and D2-like receptors in mouse eye.

[Progress in Retinal and Visual Science Research](#), November 2017, Pages 60-71

Dopamine signaling and myopia development: What are the key challenges

[Xiangbin Zhou<sup>1</sup>, Machelis T. Pardue<sup>2</sup>, P. Michael Iuvone<sup>1</sup>, Jia Qu<sup>1</sup>](#)

- D2-like receptor antagonist, spiperone blocks the protective effects of bright light and the concentration of dopamine ([Ashby and Schaeffel, 2010](#)).



- Atropine increased the release of the neurotransmitter dopamine 2000 Cambridge University Press [volume 17, Issue 2](#) March 2000, pp. 165-170 Effects of atropine on refractive development, dopamine release, and slow retinal potentials in the chick [HARTMUT N. SCHWAHN](#) <sup>(a1)</sup>, [HAKAN KAYMAK](#) <sup>(a1)</sup> and [FRANK SCHAEFFEL](#) <sup>(a1)</sup>

- Patching lowers the concentration of dopamine – causes amblyopia





# Surgical Therapy – bizarre!

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- PSR/PSC, **posterior scleral reinforcement**/contraction: Implantation von Gewebematerial zur Modellierung des hinteren Poles, fascia lata, lyophilisierte Dura, Sehnenstreifen, Aortengewebe und Spendersklera. (Russland, China, Osteuropa, USA)

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- SSI, **scleral strengthening injections**: subtenon Injektionen von Kunststoffen, Polyvinylpyrrolidone, Acrylamidhydantazide, Ethylacrylat. Ziel: Stabilisierung des Kollagens der Sklera
- AQP-1, **Aquaporin-1 Injektion** intravitreal zur Verdickung der Chorioidea

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• **Choroidal neovascularization** (Stromabfluss aus der Chorioidea) → Kardiokation, complete  
Verlust der Photorezeptoren

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# Article with a Summary of Treatment Options – written by famous researchers



**OPEN ACCESS**

Special Issue | April 2021

## IMI Prevention of Myopia and Its Progression

Jost B. Jonas; Marcus Ang; Pauline Cho; Jeremy A. Guggenheim; Ming Guang He; Monica Jong; Nicola S. Logan; Maria Litt; Ian Morgan; Kyoko Ohno-Matsui; Olavi Pärssinen; Serge Reznickoff; Padmaja Sankaridurg; S. Anj-Mei Saw; Earl L. Smith, III; Donald T. H. Tan; Jeffrey J. Walline; Christine F. Wildsoet; Pei-Chang Wu; Xiaoying Zhu; James S. Wolffsohn

✦ Author Affiliations & Notes

April 2021  
Volume 62, Issue 5  
ISSUE

Investigative Ophthalmology & Visual Science April 2021, Vol.62, 6. doi:<https://doi.org/10.1167/iovs.62.5.6>

# 2. Communication

Flyer /Leaflets

Videos / You tube

Print media

Talking to patients

# Flyer to inform population

**Therapie**

Für periphere Netzhautlöcher bleibt die Laserkoagulation (hemischer Laser) die Methode der Wahl. Eine zeitnahe Behandlung der myopen CNV ist unbedingt erforderlich, um eine Schädigung der Photorezeptoren und damit eine schwere Sehschädigung und den Verlust der Lesefähigkeit zu verhindern. Die photodynamische Therapie mit Anti-VEGF-Therapie gehört zu den ausgereiften Behandlungsoptionen der myopen CNV.

Durch den Einsatz der intravitrealen Injektionstherapie, die Anti-VEGF-Therapie, haben sich die Behandlungsmethoden der myopen CNV deutlich verbessert. Sie wird eingesetzt, wenn sich neue, krankhafte Gefäße gebildet haben. Dabei wird das Arzneimittel, ein sogenannter VEGF-Hemmer, direkt in den Glaskörper des Auges gespritzt. Die krankhaften Blutgefäße werden abgedichtet und das Wachstum neuer Gefäße wird gehemmt. Dies ermöglicht eine deutliche Visusverbesserung für die Mehrheit der Patienten.

PRO RETINA bietet auch Beratung, Begleitung und Kurienaufsicht Gleichbetroffenen. Falls wir Ihr Interesse geweckt haben, nehmen Sie bitte Kontakt mit uns auf. Wir freuen uns auf Sie!

Ihre PRO RETINA Deutschland e. V.

**Arbeitskreis Pathologische Myopie**

Der Arbeitskreis vertritt Menschen mit einer krankhaften Kurzsichtigkeit und verfolgt die Ziele:

- Information und Beratung von hochmyopen Betroffenen über mögliche Begleit- und Folgeerkrankungen
- Veranstaltungen von Patientensymposien unter Leitung von Myopie-Experten
- Austausch über aktuelle Risiken, Therapien und Forschungsergebnisse

**Kontakte:**  
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Leitung Arbeitskreis pathologische Myopie  
[r.forschbach@pro-retina.de](mailto:r.forschbach@pro-retina.de)  
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<http://blog.pro-retina.de/>

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Steuer-Nr.: 201/59024629

**PRO RETINA**  
Deutschland e. V.  
Hilfsorganisation von Menschen mit  
Hochmyopie

**Pathologische Myopie**

Was Sie über krankhafte Kurzsichtigkeit wissen sollten

Informationen für hochgradig Kurzsichtige

PRO RETINA-Mitglieds Nr. 11/2015





# 3 Parents

not easy to deal with

Presenting the possible treatment options

Explaining need of treatment

Trying to convince them for

Acting in concert

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In antique times: The Holy Family

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Today the „holy“ children.  
Super educated, coming  
close to Nobel Prize  
winners!



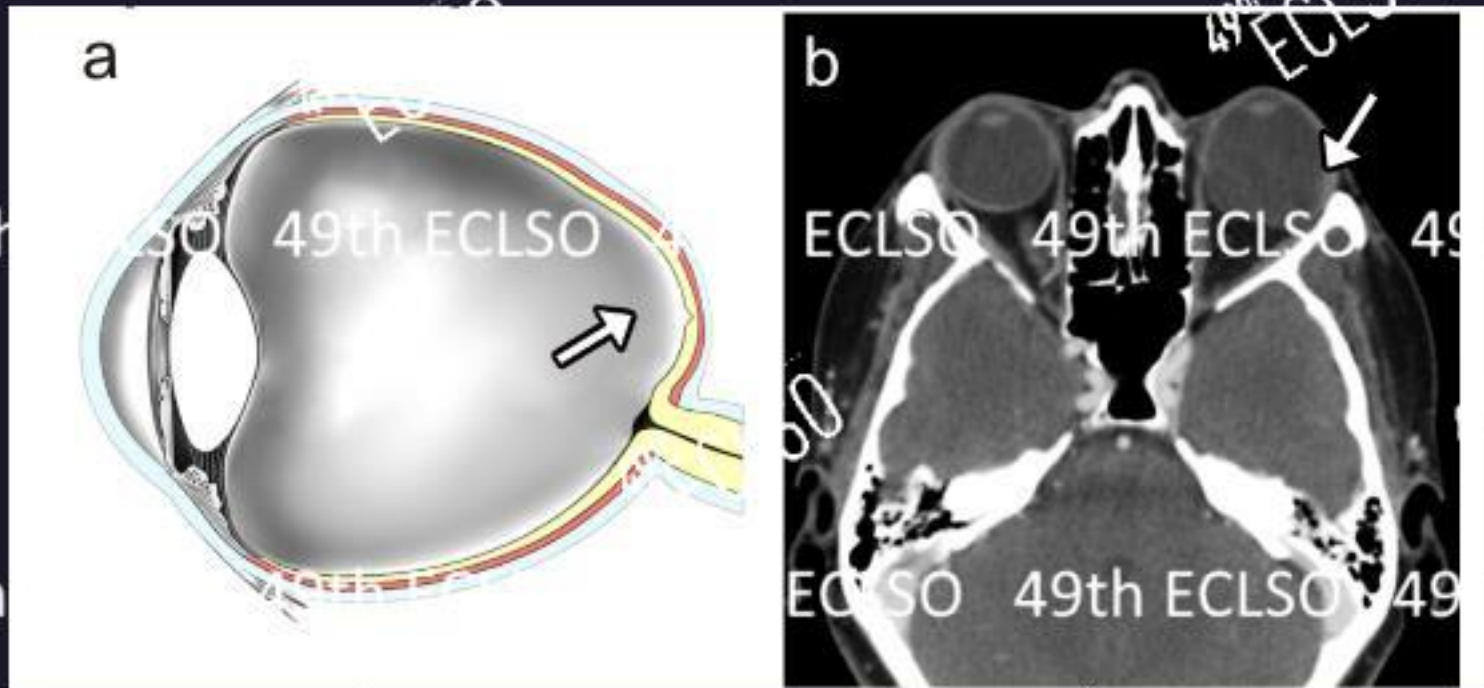
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# Explanation to the Parents

## Complications of high myopia



### Pathologische Myopie

Ungefähr 0,1—0,3 % der westlichen und 3,0 % (bis zu 7%) der asiatischen Bevölkerung leiden unter pathologischer Myopie (fortschreitende axiale Ausdehnung des Auges und die darauf beruhenden pathologischen Veränderungen der Aderhaut (Chorioidea) und Netzhaut (Retina)).

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# 5. Outcome / Result

Measurable  
Gaining lines?

Wearing of glasses?

Bulbus length is important

Absence of fundus abnormalities (high myopia)

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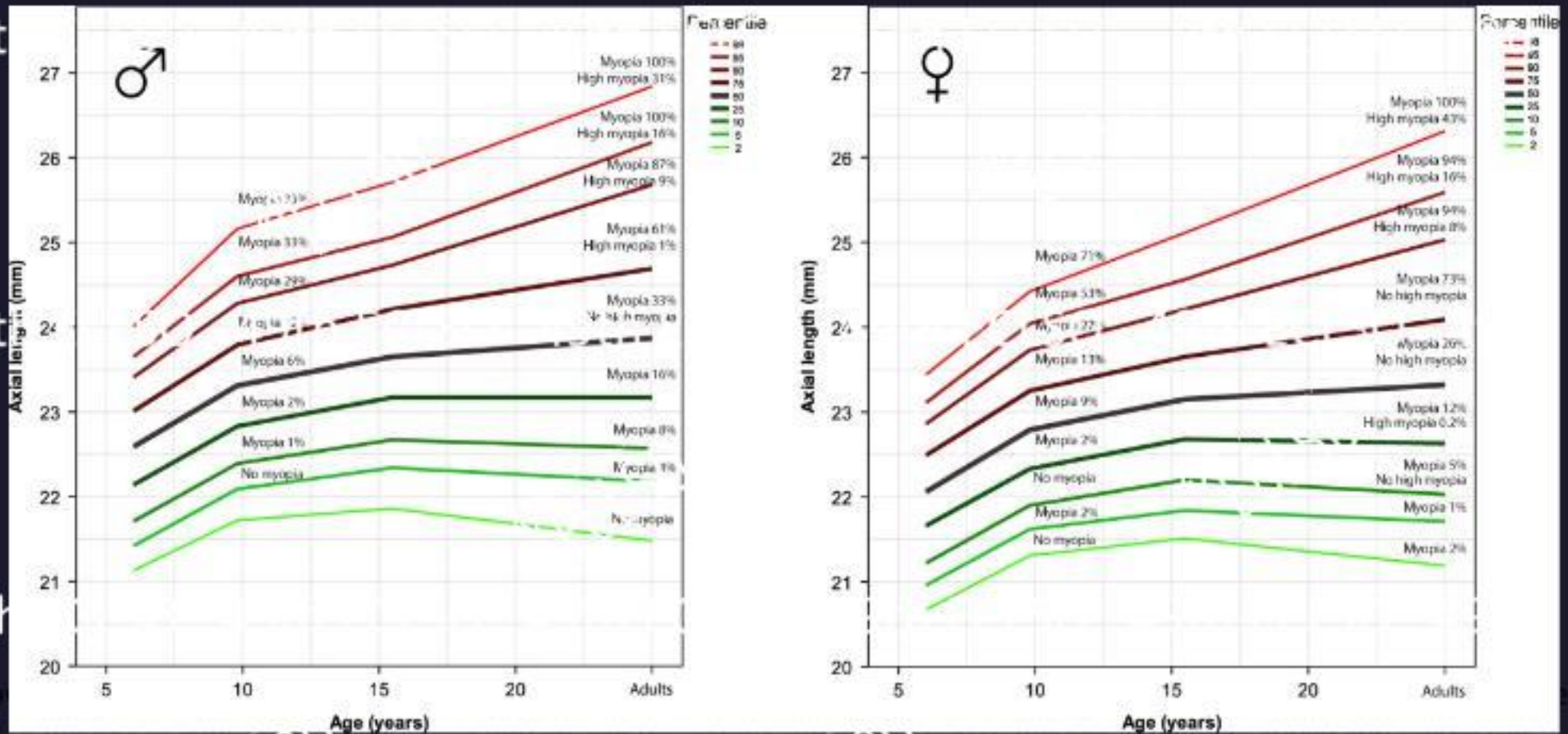
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Our normative data regarding AL may serve as a key instrument for monitoring eye growth in children with progressive myopia in European and other populations.

CHILDREN STARTING WITH 6 YEARS

Prognosis to communicate!!



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# Take Home

Whatever you do,  
whatever you try,  
whatever parents and  
children are willing to  
follow is better than just  
observe!

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