Sclera Crosslinking (SXL)

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myopia

1. Basic science
2. Myopia control
3. Sclera procedures
During emmetropization the axial length of the eye is adjusted to the dioptric power of cornea and lens.

This adjustment process is influenced by peripheral vision (not foveal!) and some chemical factors, f.e. dopamin.
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Muscarinic antagonists may also reduce the axial enlargement of the eye.
Human sclera is nonlinear elastic


However: high variability

FIGURE 4. Stress-strain plots of the (a) vertical and (b) horizontal human posterior scleral samples in the elastic region from uniaxial tests at 1 mm/s in 37°C saline (n=12 for vertical and n=11 for horizontal). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Elastic properties of human posterior eye.

Kibens S. Keesten AM, Westgard RD, Hovig MN.
Human sclera is viscoelastic


**basics: biomechanics sclera**

![Graph showing creep test results](image)

**Biomechanics sclera**

Siegwart JT, Norton TT
Regulation of the mechanical properties of tree shrew sclera by the visual environment.

- **sclera creep rate**: 2 to 3 mm/h
- **monocular form deprivation (4 days)** with eye elongation
  - increase 200 to 300%
  - temporal correspondence
myopia

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myopia control: refractive

Undercorrection of glasses and contacts:

- gold standard in the old days, today rather conversely discussed
ATOM studies (Atropin for the Treatment of Myopia, Singapur)

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)

→ prospective, doppel-blind study in big groups. Clearly defined inclusion and success criteria
myopia control: pharmacological

ATOM Studien (Atropin for the Treatment of Myopia, Singapur)
Aber...

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Historical background: Posterior scleral reinforcement

- Last negative publication in Europe
  - Chauvaud D et al., J Fr Ophthalmol, 1997
- Last negative publication in Asia
  - Li XI et al., Int J Ophthalmol 2016

Only limited success with significant side-effects

**myopia control: surgical**

**SXL chemical**

Probably effective, side effects expected but unknown

Tai-Xiang Liu, Zheng Wang
Acta Ophthalmol 2013

In Vivo Crosslinking of Scleral Collagen in the Rabbit Using Sub-Tenon Injection of Nitroalcohol. Paik ARVO 2014
Scleral Crosslinking: Riboflavin + UV, immediate results


Scleral crosslinking in young rabbits with focal irradiation - elongation results:

But.... Experimental procedures used in rabbits* had disadvantages: focal spots, very invasive


myopia control: surgical

Next generation SXL: LED-belt with scattering interface
myopia control: surgical

Next generation SXL: Laser coupled into waveguide

No surgical complications (n=12)
ICG angiography indicating safety
Extensiometry indicating efficacy
Take Home Messages:

1. None of the so far presented approaches of myopia control (refractive, pharmacological, surgical) is optimal.

2. The pharmacological approach with 0.01% Atropin appears to be feasible and safe. However, expectations are higher than results.

• Scleral crosslinking has passed successfully the experimental state and clinical studies are planned.

Thanks for your attention

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