

# Hyaluronic acid

---

Classifications, characteristics and clinical effects





# Hyaluronic acid

---

Classifications, characteristics and clinical effects

---

# Hyaluronic acid for dry eyes

Hyaluronic acid has been used in surgical procedures on eyes since the 1960s. This is primarily due to their property of having elastic flow behaviour.

---

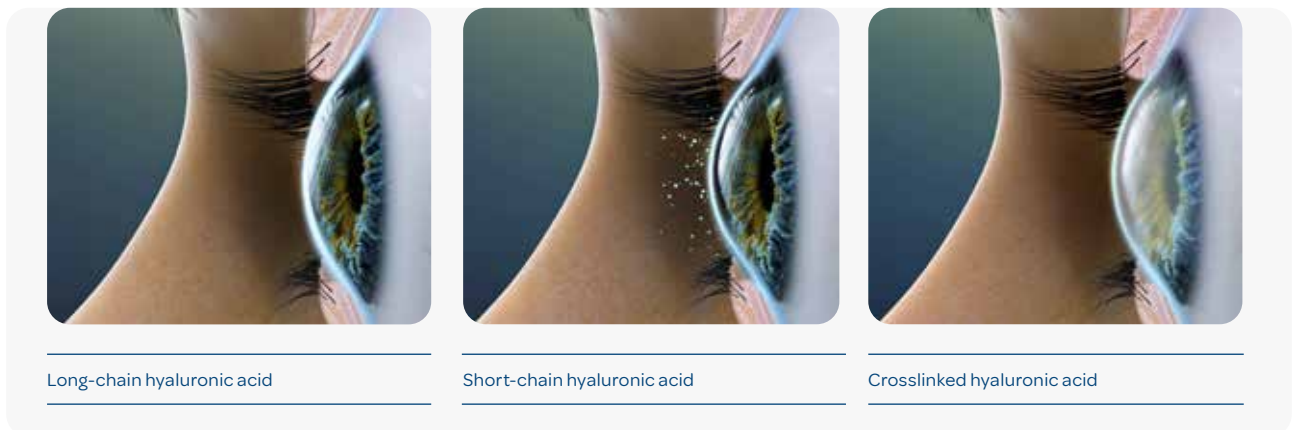
## Long-chain hyaluronic acid within ophthalmology

- Hyaluronic acid is often used in artificial tears as a viscosity enhancer to treat symptoms of dry eye because it provides long-lasting moisture to the surface of the eye.
- Dry eyes benefit particularly from long-chain hyaluronic acid, as it has a high viscosity and therefore a long residence time on the eye without affecting visual acuity (Figure 3).
- Long-chain hyaluronic acid is also important in post-operative follow-up care to provide long-lasting moisturisation, which has a favourable effect on the healing process.

---

## Short-chain and cross-linked hyaluronic acid as a therapy option?

- Short-chain hyaluronic acid is less suitable in ophthalmology because it can only form low-viscosity solutions. These do not remain on the surface of the eye for long, and drops need to be applied more frequently.
- Cross-linked hyaluronic acid is not the first choice in ophthalmology because, due to crosslinking, the gel formation makes it difficult for viscosity to decrease during blinking, which can lead to visual impairment.



**Fig. 3:** Only long-chain hyaluronic acid has a long residence time on the surface of the eye

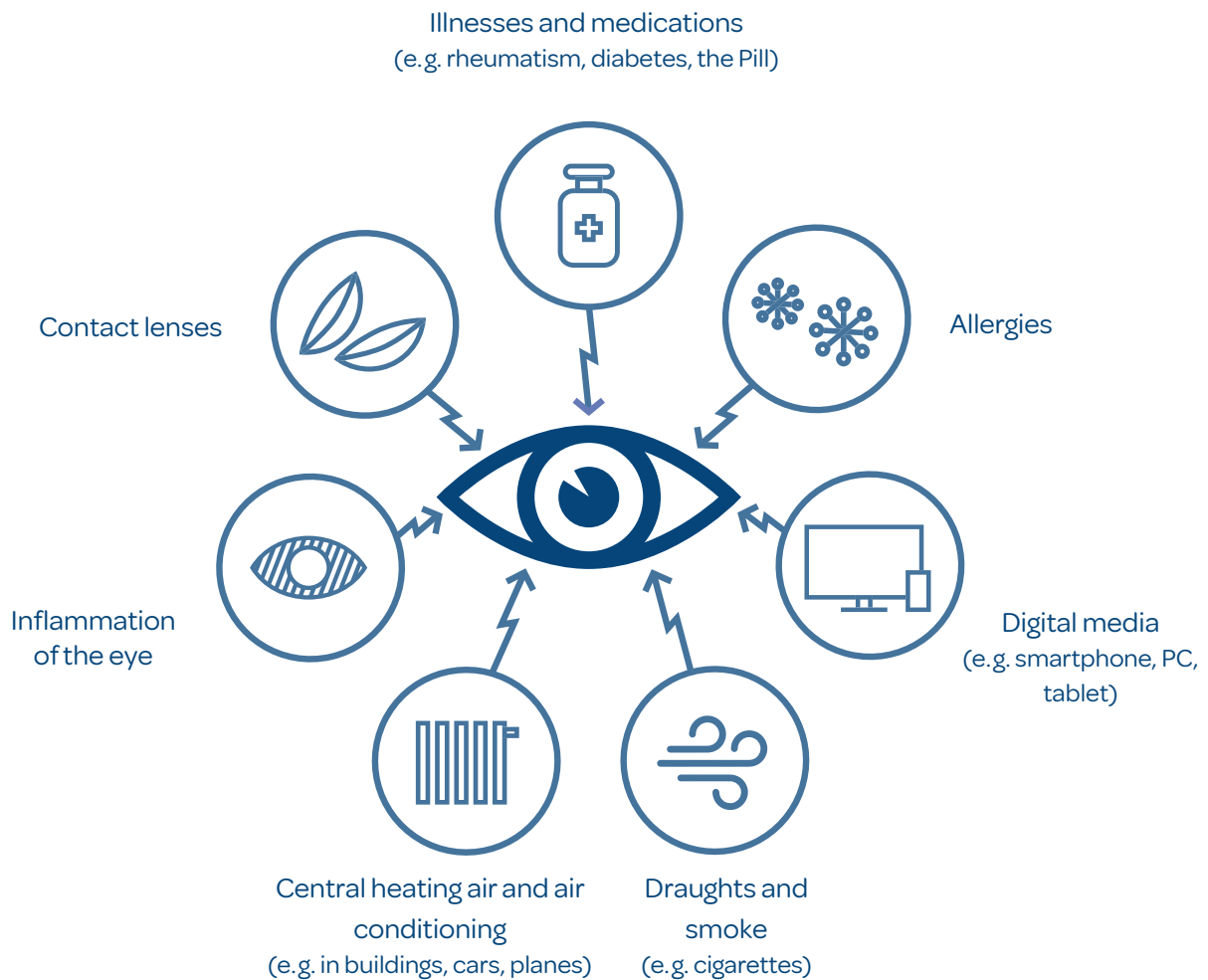


Long-chain hyaluronic acid has been used in a variety of applications in ophthalmology for decades. Short-chain and crosslinked hyaluronic acid, on the other hand, are more suitable in other specialties.

## Dry eye at a glance

About 14 million people in Germany suffer from dry eyes. This equates to about a fifth of the population. Dry eyes can be triggered by a variety of causes (Fig. 4). Affected people may experience painful symptoms (e.g. foreign body or gritty sensation), itchy, burning,

red or watery eyes, which can be a daily burden and have a negative impact on their life. The first approach in treating dry eye is based on a tear substitute, which is used to moisten the surface of the eye and reduce mechanical friction.



**Fig. 4:** Possible triggers of dry eyes

Dry eyes also have a variety of triggers and symptoms. The first treatment approach is a tear substitute that replicates the natural tear film as well as possible.

## High viscoelasticity: Rapid change of viscosity for non-Newtonian fluids

High-viscosity eye drops enable better adhesion and therefore a long-lasting residence time and prolonged efficacy of the preparation on the ocular surface. This is particularly relevant for sufferers with more severe symptoms, as it can reduce the number of times eye drops need to be applied. The higher viscosity also results in a greater physical protective function for the cornea and conjunctiva.

High viscoelasticity means:

- **Rapid decrease in viscosity when blinking** ('shear thinning')

This forms a thin film on the surface of the eye that spreads evenly. Visual impairment is avoided due to the reduced viscosity.

- **Rapid change back to high viscosity with the eye open** ('pre-blink')

This ensures a long residence time on the surface of the eye. In addition, the high viscosity contributes to the stability of the (artificial) tear film.

The greater the difference between the viscosity before blinking and the viscosity during blinking under the effect of shear forces, the more viscoelastic the tear substitute (fig. 7) and the better this ensures high tear stability, low friction and good distribution of the eye drops during blinking [6].

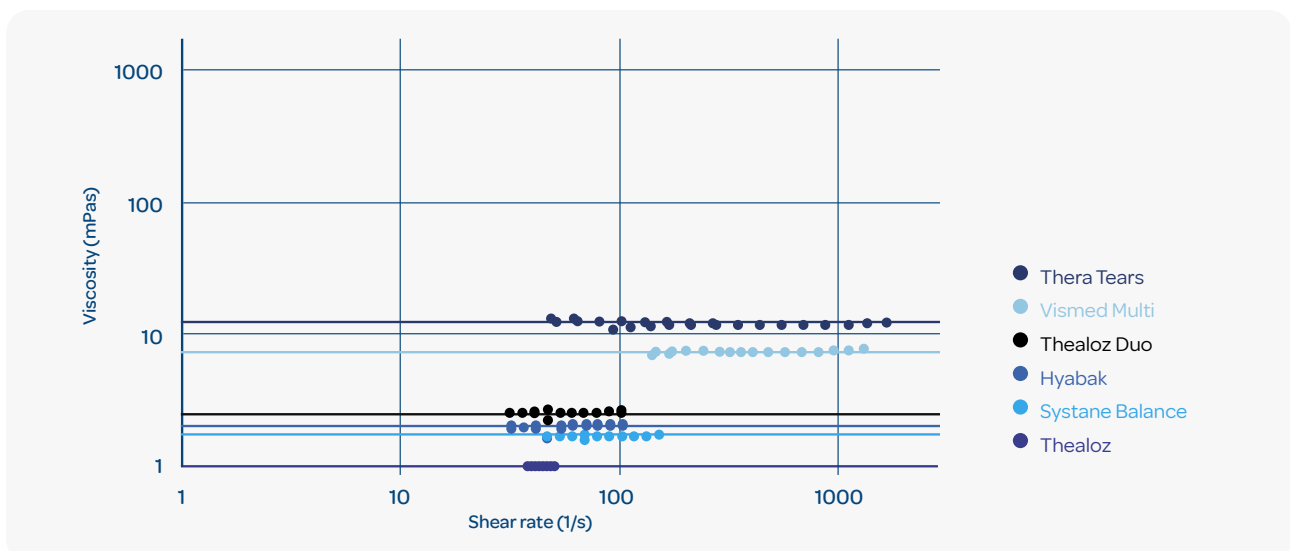
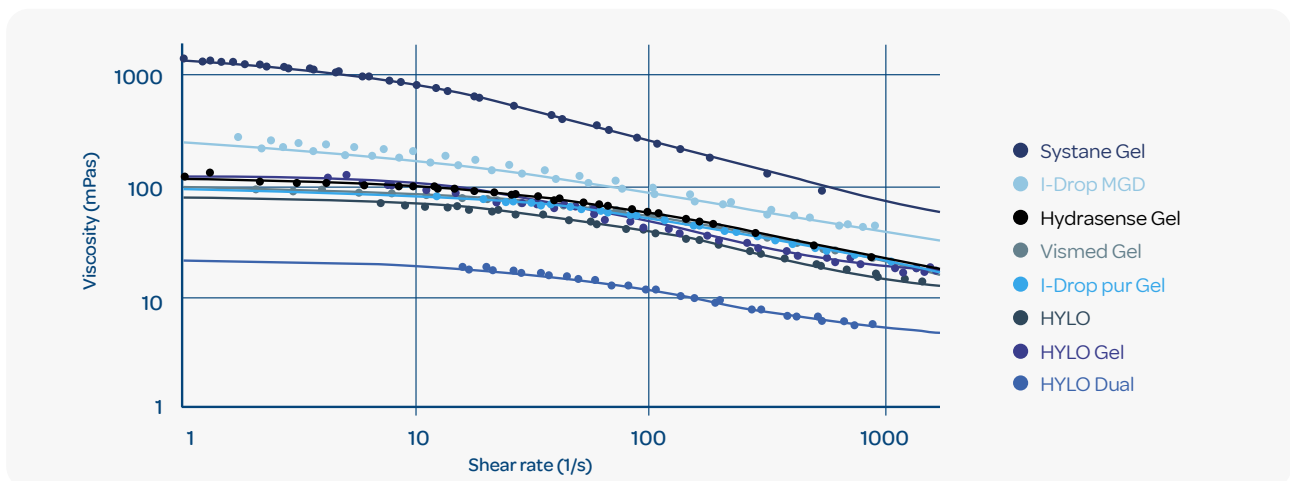
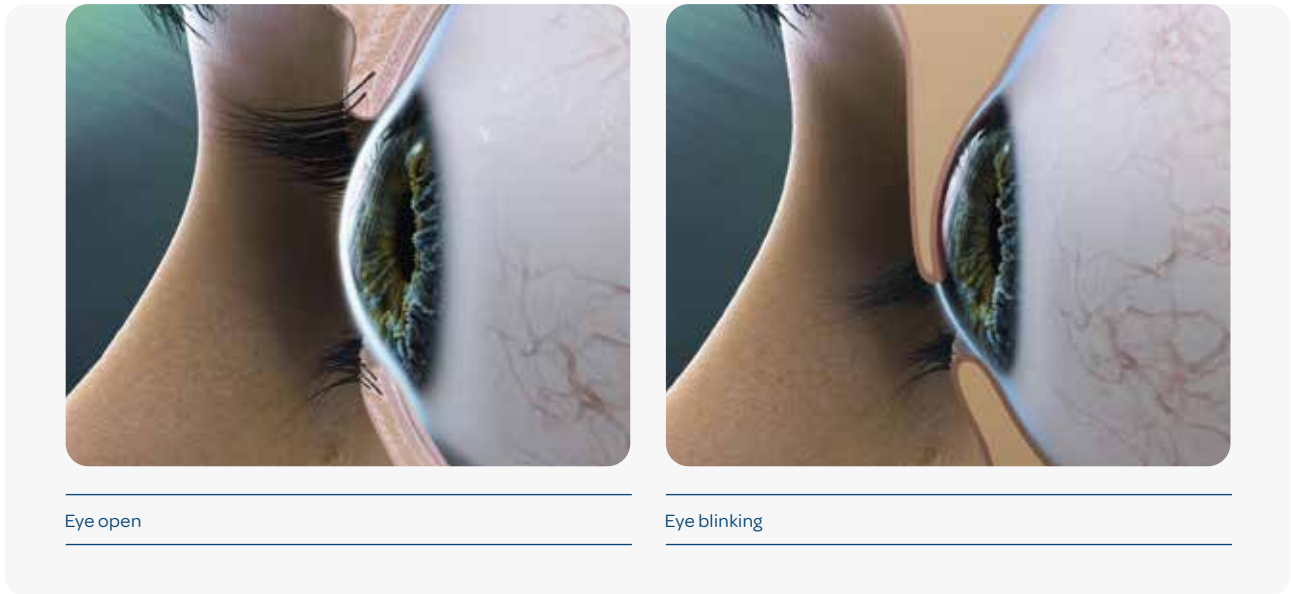


Fig. 7: Comparison of different eye wetting agents with and without hyaluronic acid in terms of elasticity [according to 6]



**Fig. 8:** High-viscosity eye drops show very good adhesion and prolonged efficacy on the ocular surface.

## High (initial) viscosity: Vital for the intensity and duration of moisturisation

High-viscosity eye drops enable better adhesion and therefore a long-lasting residence time and prolonged efficacy of the preparation on the ocular surface. This is particularly relevant for sufferers with more severe

symptoms, as it can reduce the number of times eye drops need to be applied. The higher viscosity also results in a greater physical protective function for the cornea and conjunctiva.

## No visual impairment

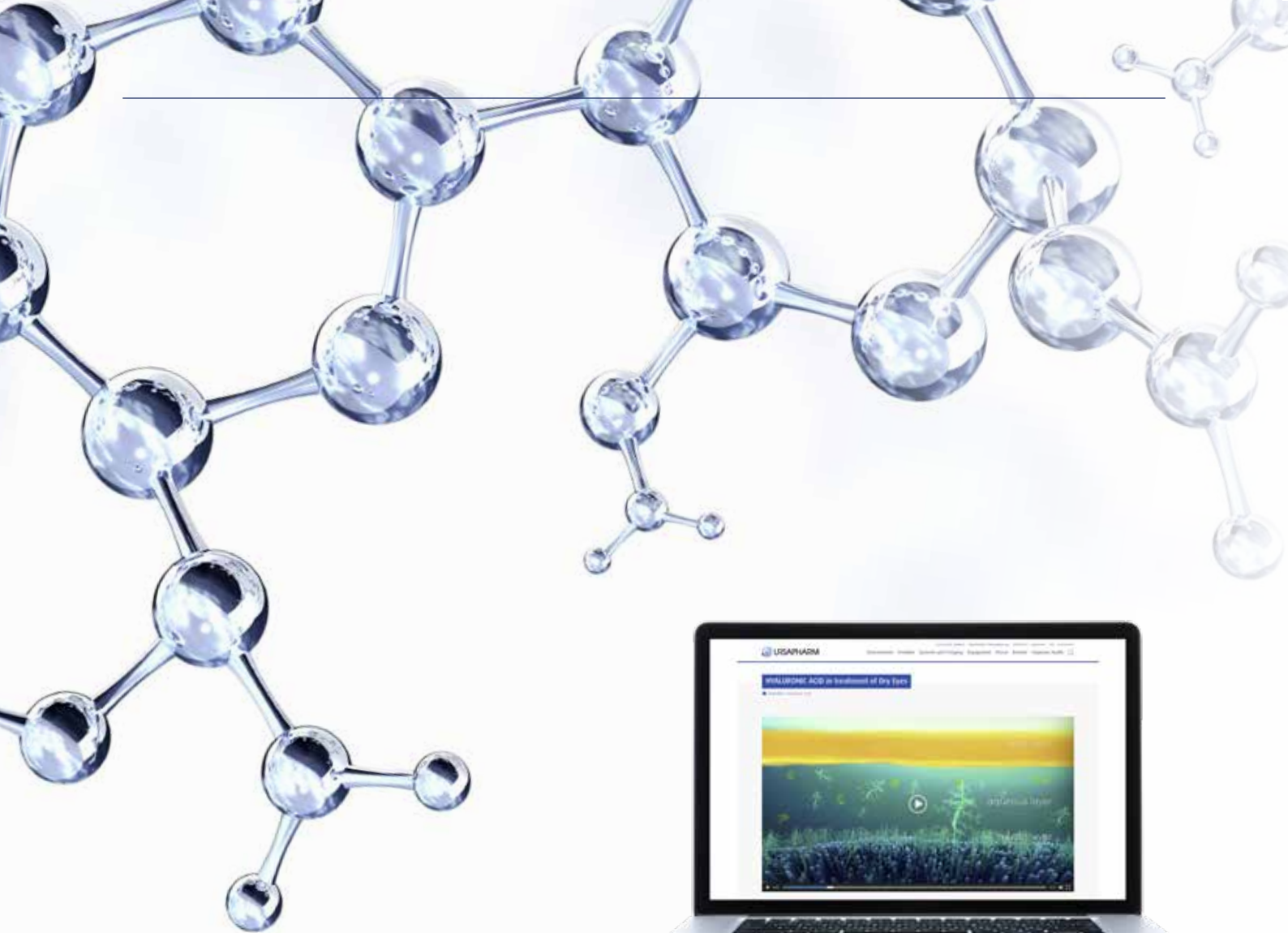
If the viscosity of eye drops is too high, it may temporarily impair visual performance. Consequently, the ideal artificial tear is not only about having the highest possible viscosity, but also about physiological flow properties that are similar to those of the natural tear fluid. With

high-viscosity preparations in particular, care must be taken to ensure that the viscosity is sufficiently reduced by blinking so that no visual impairment is caused<sup>[7]</sup>.



Long-chain hyaluronic acid meets the requirements for optimal artificial tears superbly!

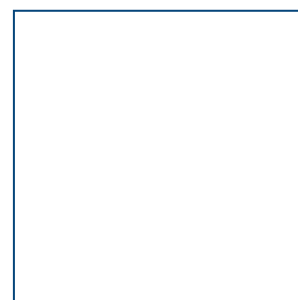




# Hyaluronic acid like you've probably never seen it before!

Discover the molecular structure, mechanism of action and benefits in our 3D training video!

Simply scan the QR code or visit online at:  
[www.ursapharm.de/en/lp-hyaluronic-acid](http://www.ursapharm.de/en/lp-hyaluronic-acid)



---

# References

- 1) Meyer K, Palmer JW. J Biol Chem 1934; 107: 629 – 634
- 2) Balazs, EA et al. Proc. Int Congr & First Film Festival on Intraocul Implant, Cannes, France, May 1979
- 3) Polack FM, Mc Niece M. Cornea 1982; 1: 133 – 136
- 4) Müller-Lierheim WGK. Diagnostics 2020; 10: 511; doi: 10.3390/diagnostics10080511
- 5) Arshinoff S, Hofmann I, Nae H. J Cat Ref Surg 2021; 47: 655 – 661
- 6) Arshinoff S, Hofmann I, Nae H. J Cat Ref Surg 2021; 47: 649 – 654
- 7) Aragona P, Simmons PS, Wang H, Wang T. TVST 2019; 8: 1 – 8
- 8) Jiang D, Liang J, Noble P. Phys Rev 2011; 91: 221 – 264
- 9) Stiebel-Kalsish H et al. Eye 1998; 12: 829 – 833
- 10) Gomis, A. Arthritis Rheum 2004; 50, 1: 314 – 326
- 11) Camillieri G et al. J Ocul Pharm Ther 2004; 20, 6: 548 – 553
- 12) Van Setten GB et al. J Clin Med 2020; 9, 3536; doi: 10.3390/jcm9113536)
- 13) Feinberg R, Beebe D. Science 1983; 220: 1177 – 1179
- 14) West DC, Kumar S. Exp Eye Res 1989; 183: 179 – 196
- 15) Slevin M et al. Matrix Biol 2007; 26: 58 – 68
- 16) Pauloin, T. et al. Eur J Pharm Sci 2008; 34, 4 – 5: 263 – 273
- 17) Pauloin, T. et al. Mol Vis 2009; 15: 577 – 583
- 18) Wu, CL et al. Electrophoresis 2013; 34: 388 – 396
- 19) Argüeso P et al. IOVS 2002; 43: 1004 – 1011
- 20) Bron AJ et al. Ocul Surf 2017; 15: 438 – 510
- 21) Baudouin C et al. Prog Ret Eye Res 2019; 71: 68 – 87
- 22) Kunert KS. ZPA 2014; 35: 69 – 75





---

**Dublin**

Suite 5,  
Westland House,  
Westland Park,  
Willow Road,  
Dublin 12  
D12 Y012  
Republic of Ireland

---

Phone: + 353 1 525 3683

Email: [retailsales@scopeeyecare.com](mailto:retailsales@scopeeyecare.com)

---

**London**

First Floor, Unit 4,  
Amberley Court,  
Whitworth Road,  
County Oak Way,  
Crawley,  
West Sussex  
RH11 7XL, UK

---

Phone: +44 800 270 0253

---

**New York**

79 Madison Avenue,  
8th Floor,  
New York,  
NY 10016,  
USA

---

Phone: USA: +1 917 795 4227

Email: [hello@optase.com](mailto:hello@optase.com)

---

[scopeconnect.com](http://scopeconnect.com)