

CEDEMATOUS CORNEAL REACTIONS

ODM5[®]

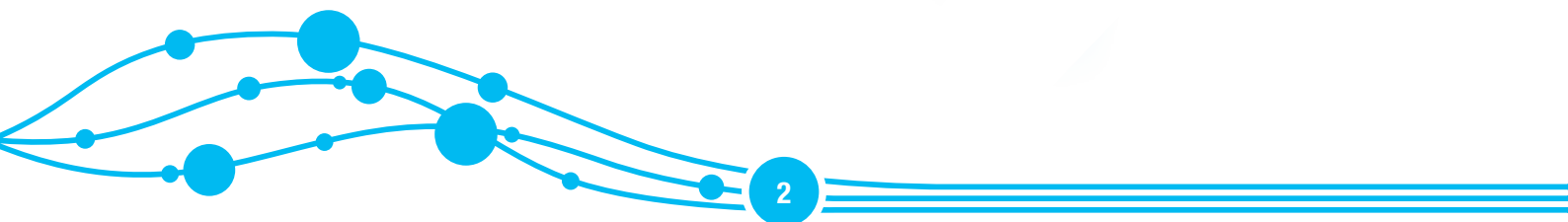
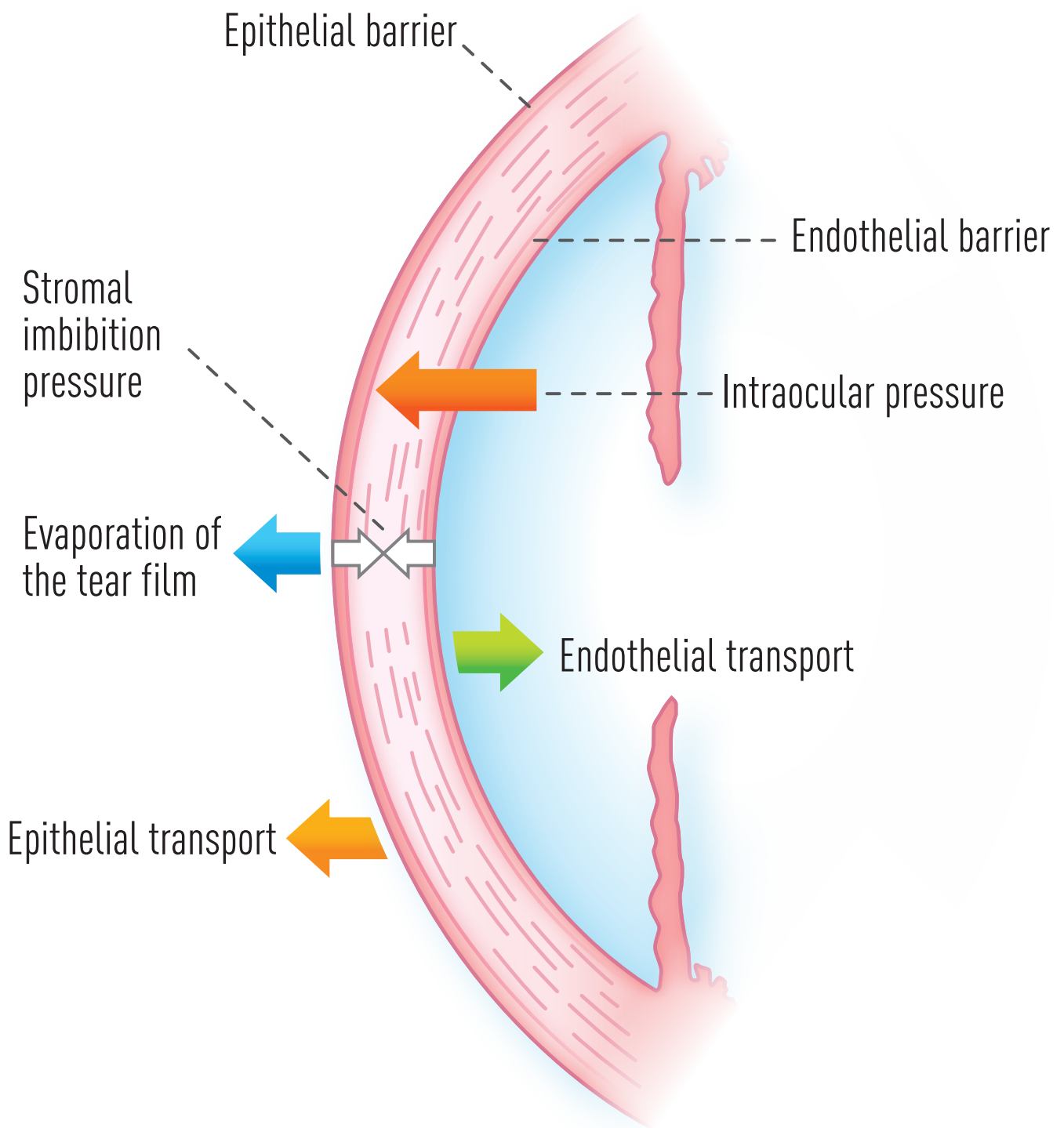
SEE LIFE CLEARLY



PRACTICAL GUIDE

CORNEAL HYDRATION...

...A FRAGILE BALANCE



ŒDEMATOUS CORNEAL REACTIONS

CORNEAL DYSTROPHY

Endothelial dystrophy _____

Epithelial dystrophy _____

POST- SURGERY

Cataract surgery and
corneal œdema _____

Corneal graft
and corneal oedema _____

POST- TRAUMATIC

Recurrent keratalgia _____

Non-perforating
ocular trauma _____

ENDOTHELIAL DYSTROPHY

(e.g.: Fuchs dystrophy)



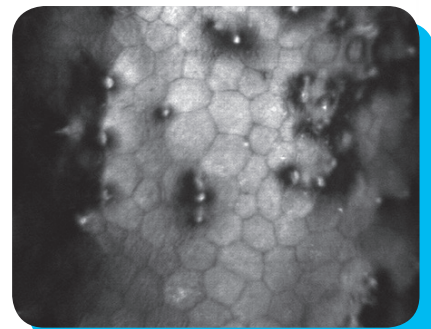
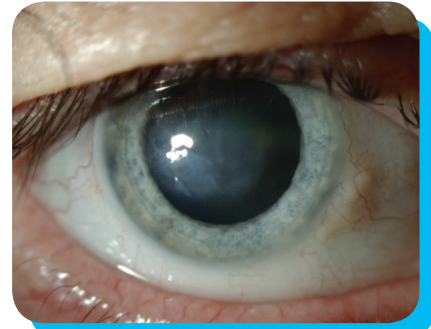
Pathophysiological notes

Fuchs dystrophy is the most common cause of decompensation of the endothelial pump. It probably corresponds to a hereditary acceleration of ageing of the endothelium.

Corneal involvement is manifested by protrusions in the Descemet's membrane, forming "drops" (guttae) and a loss of endothelial cell density. It leads to stromal, then epithelial hyperhydration of the cornea, with bullous keratopathy.

Fuchs dystrophy is a progressive disease that usually appears after 40 years of age.

It is more common and more severe in women. The disease can be exacerbated by trauma, surgery, and exposure to toxins and infections. It is not known if the corneal guttae, which tends not to progress, is an entity distinct from Fuchs dystrophy.



Clinical signs and symptoms

It may be entirely asymptomatic and the guttae may only be revealed during a routine SL* examination.

- SL: pigmentation - Specular: atrophy in "drops" (guttae)

The symptoms are worse in the morning

- Vision may be blurred upon waking, a phenomenon that can become permanent in advanced stages
- Glare with a halo around light sources
- Photophobia

Without treatment, the disease can progress to a loss of corneal epithelial sensitivity and corneal opacity.

*SL: slit lamp.

References

Fuchs E. Dystrophia epithelialis corneae. Graefe's Arch Clin Exp Ophthalmol 1910; 76: 478-508.
Borderie V, Baudrimont M, Bourcier T. Journal Français d'Ophtalmologie 1999; 22(9): 987.
Eghrari A O, Gottsch J D; Fuch's corneal dystrophy; Expert Rev Ophthalmol. 2010 April; 5(2): 147-159.



Therapeutic objectives

Symptomatic:

- Improve morning vision by increasing the osmolarity of the corneal surface, or by drying when going to bed and rising.
- Increase visual comfort to delay the graft
- Surgical treatment by keratoplasty
- The culture of endothelial cells is a future therapy in development



Did you know...

In order to describe the progression of morning visual impairment, Austrian ophthalmologist Ernst Fuchs examined a patient repeatedly at several times during the day. He described the damage caused by the epithelial pathology in his initial description of 1910.



Mechanism of action

ODM 5[®]

NaCl 5%

Osmotic effect⁽¹⁾

- Pumps excess fluid from corneal tissue⁽¹⁾
- Promotes corneal transparency⁽²⁾
- **Improves visual acuity⁽³⁾**

HA 0.15%

Protective effect⁽⁴⁾

- Stabilises the tear film⁽⁵⁾
- Promotes corneal healing⁽⁶⁾
- **Improves eye comfort**



Dosage

1-2 drops 4 times per day, preferably during the first two hours after waking hours, until reduction of oedema⁽³⁾.

1. Insler MS, Benefield DW, Ross EV, Topical Hyperosmolar Solutions in the Reduction of Corneal Edema, CLAO J. 1987; 13(3): 149-151.
2. I. Knezovic, I. Dekaris, N. Gavric, J. Cerovski, A. Barisic, D. Bosnar, P. Rastegorac, A. Parac, Therapeutic efficacy of 5% NaCl Hypertonic solution in patients with bullous keratopathy, Coll. Antropol. 30 (2006) 2: 405-408.
3. Rouland, J.F - Etude clinique pilote évaluant l'efficacité d'une solution ophtalmique hyperosmolaire sans conservateur chez des patients présentant un œdème cornéen symptomatique. JFO - 2015.
4. Debbasch C, Bruneau De La Salle S, Brignole F, Rat P, Warnet JM, and Baudouin C, Cytoprotective Effects of Hyaluronic Acid and Carbomer 934P in Ocular Surface Epithelial Cells, Investigative Ophthalmology & Visual Science, November 2002, 43(11): 3409-15.
5. Mengher L, Pandher K, Bron A, Davey C, Effect of sodium hyaluronate (0.1 %) on break-up time (NIBUT) in patients with dry eyes, British Journal of Ophthalmology, 1986, 70, 442-447.
6. Camillieri G, Bucolo C, Rossi S, Drago F, Hyaluronan-induced stimulation of corneal wound healing is a pure pharmacological effect, J Ocul Pharmacol Ther, 2004; 20(6): 548-53.

EPITHELIAL DYSTROPHY

(e.g.: Cogan's dystrophy)

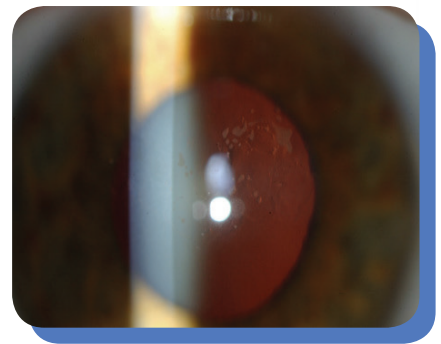


Pathophysiological notes

This bilateral condition is the most common of the corneal dystrophies (more than 2% of the population).

It is due to an abnormality in the basal membrane of the epithelium, forming intraepithelial gaps; repeated abrasions occur as a consequence of poor epithelial adhesion.

The condition first appears during adolescence. Hypotonicity of the tears in bullous keratopathy causes epithelial oedema, promoting the formation of blisters.



Clinical signs and symptoms

Clinical signs:

- SL*: greyish intraepithelial vesicles, punctate opacities, "fingerprint," "dot" or "map" lesions most easily visible using retroillumination with dilated pupils

Variable symptoms:

- Tearing
- Visual impairment, loss of visual acuity
- Shooting pain if erosions



Therapeutic objectives

- Improve adhesion between the constituent layers of the cornea.
- Relieve pain
- Lubricate the cornea
- Improve vision
- Limit corneal erosions

*SL: slit lamp.

References

Dighiero P, Ellies P et al.; Mise au point sur les dystrophies de cornée; J FR Ophtalmo 1999; 22(2); 226-33.
Bourges JL, Dighiero P et al.; la photokératectomie thérapeutique dans le traitement de la dystrophie microkystique de Cogan; J Fr Ophtalmol 2002; 25(6); 594-8.



Did you know...

Phototherapeutic keratectomy is the treatment of choice for forms of the disease resistant to medical treatment, but long-term recurrence remains possible and has been the subject of little research.

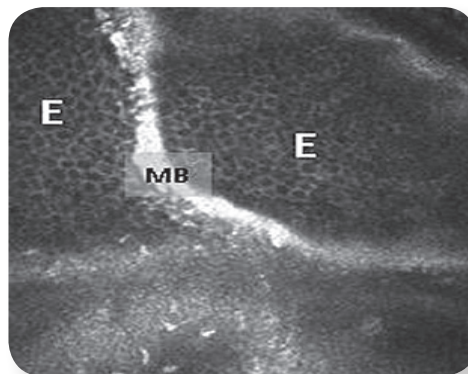


Image under confocal microscopy

2



Mechanism of action

ODM 5[®]

NaCl 5%

Osmotic effect⁽¹⁾

- Dehydrates the corneal tissue⁽²⁾
- Promotes epithelial adhesion⁽⁶⁾
- Prevents recurrence⁽²⁾
- Reduces corneal oedema⁽¹⁾

HA 0.15%

Protective effect⁽³⁾

- Stabilises the tear film⁽⁴⁾
- Promotes corneal healing⁽⁵⁾



Dosage

1-2 drops 4 times per day during episodes, especially in the evening at bedtime⁽²⁾.

1. Insler MS, Benefield DW, Ross EV, Topical Hyperosmolar Solutions in the Reduction of Corneal Edema, CLAO J. 1987; 13(3): 149-151.
2. Nicholas Brown And Anthony Bron, Recurrent erosion of the cornea, Brit. J. Ophthal. [1976] 60, 84.
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6. Fadlalaah A, Legeais JM, Les k ratalgies r cidivantes et leurs traitements cicatrisants, Les Cahiers d'Ophthalmologie, Tir   part, May 2014.

CATARACT SURGERY AND CORNEAL ŒDEMA



Pathophysiological notes

Cataract surgery is the most common ophthalmic intervention. Progress in techniques has helped to greatly reduce the risks of surgery. Nonetheless all intraocular procedures are traumatic for endothelial cells.

Anterior chamber implants carry the highest risk for endothelial damage. Postoperative corneal Œdema may be either localised or diffuse, stromal and/or epithelial.

Persistent pseudophakic corneal Œdema is a complication that can become disabling, and remains a major indication for corneal transplants.



Risk factors

Intraoperative endothelial trauma, pre-existing endothelial pathology, significant postoperative inflammation, sustained elevation of postoperative IOP.



Clinical signs and symptoms

Clinical signs:

- Clouded cornea

Variable symptoms:

- Tearing
- Visual impairment
- Loss of visual acuity on waking



Therapeutic objectives

- Evaluation of endothelial cells before surgery
- Respect and protect the corneal tunic during surgery and the postoperative period
- Promote the return of the cornea to its optimal physiological state

References

Narayanan R, Gaster R N. et al. Pseudophakic Corneal Edema: A Review of Mechanisms and Treatments; Cornea 2006; 25(9): 993-1004. The Cornea: Scientific Foundations and Clinical Practice. 3rd ed. Lippincott William & Wilkins: 1994. 635-643. Hayashi K, Hayashi H, Nakao F, Hayashi F. Risk factors for corneal endothelial injury during phacemulsification. J Cataract Refract Surg. 1996 Oct. 22(8): 1079-84.



Hypertonic eye drops may improve vision⁽⁴⁾ pending the graft. In less severe cases and in the presence of risk factors for postoperative corneal oedema, such eye drops may also permit faster recovery of corneal transparency. Where endothelial decompensation is demonstrated, keratoplasty is the only treatment.



Did you know...

Endothelial cells have limited mitotic capacity for renewal. After 20 years of age, the loss of endothelial cells is around 0.5% per year. Cataract surgery causes loss of endothelial cells estimated at 9% at 1 year and 12% at 3 years⁽¹⁾.

In some cases, the endothelial pump can take several months to regain its full capacity and ensure corneal transparency.

3



Mechanism of action

ODM 5[®]

NaCl 5%

Osmotic effect⁽²⁾

- Draws fluid out of corneal tissue⁽²⁾
- Promotes corneal transparency⁽³⁾
- Improves visual acuity⁽⁴⁾

HA 0.15%

Protective effect⁽⁵⁾

- Stabilises the tear film⁽⁶⁾
- Promotes corneal healing⁽⁷⁾
- Improves eye comfort



Dosage

1–2 drops, preferably 4 times per day until reduction of oedema.

In case of blurred vision in the morning: instil during the first two hours after waking⁽⁴⁾.

1. Borderie, Baudrimont, Touzeau, Laroche, Cédème cornéen, EMC. Ophtalmologie, 21-200-C-25, 1999.
2. Insler MS, Benefield DW, Ross EV, Topical Hyperosmolar Solutions in the Reduction of Corneal Edema, CLAO J. 1987; 13(3): 149-151.
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CORNEAL GRAFT AND CORNEAL ŌDEMA



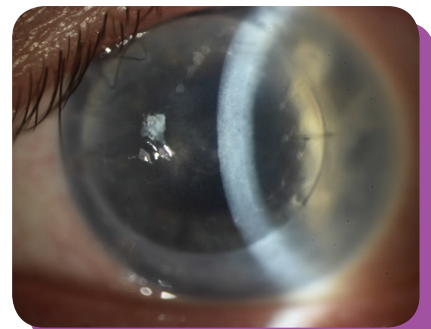
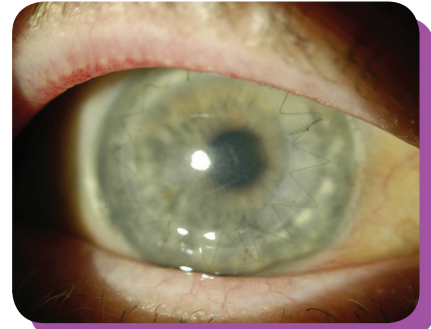
Pathophysiological notes

Corneal graft replaces a diseased, opaque cornea with a healthy, transparent cornea.

In cases of irreversible endothelial decompensation, corneal transplantation involves placing a new layer of endothelial cells capable of restoring and maintaining corneal transparency.

The cornea is composed of a dense, avascular connective tissue with few cells, and the transplant success rate is high.

A good prognosis is further improved if the preoperative stromal ōdema has been active for a shorter period.



Clinical signs and symptoms

Clinical signs:

- Clouded cornea

Variable symptoms:

- Tearing
- Visual impairment
- Loss of visual acuity on waking



Therapeutic objectives

- Before graft: relieve visual discomfort due to ōdema, and reduce corneal thickness
- After graft: accelerate the return of the cornea to its optimal physiological state

References

Morishige N, Chikama T, Yamada N, Takahashi N, Morita Y, Nishida T, et al. Effect of preoperative duration of stromal edema in bullous keratopathy on early visual acuity after endothelial keratoplasty. J Cataract Refract Surg. 2012 Feb. 38(2): 303-8.

Armitage W J. et al. The first successful full-thickness corneal transplant: a commentary on Eduard Zirm's landmark paper of 1906. Br J Ophthalmol. 2006 Oct; 90(10): 1222-1223.



Did you know...

- The first successful corneal transplant was performed in 1905 by Eduard Zirm
- The cornea is the most commonly graft of solid tissue.



Mechanism of action

ODM5[®]

NaCl 5%

Osmotic effect⁽¹⁾

- Draws fluid out of corneal tissue⁽¹⁾
- Promotes corneal transparency⁽²⁾
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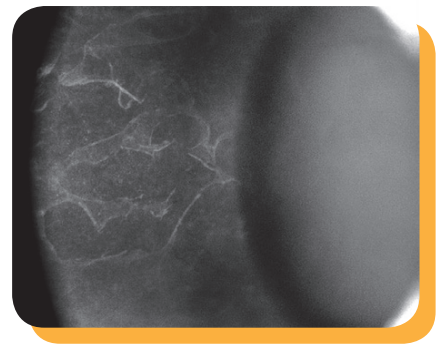
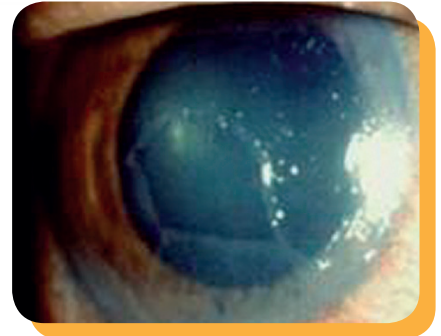
RECURRENT KERATALGIA



Pathophysiological notes

In this disease, the epithelial surface loses its regularity and exhibits localised oedemas. Recurrent erosions are due to loss of stromal adhesion in the corneal epithelium.

Where the pathology was caused by trauma, the adhesion of scarred epithelium is weakened by a default in the reconstitution of the basal lamina and hemidesmosomes. Erosions occur as the epithelium becomes detached when the eyelids are opened.



Clinical signs and symptoms

- SL*: localised epithelial oedema, no epithelial loss, no blistering and no epithelial cysts.
- Recurrent corneal erosions.
- Rarely occurs bilaterally (10%).
- Recurrent corneal pain, usually upon awakening.
- Photophobia, tearing, eye redness.
- Sometimes significant visual impairment in case of larger erosions.



Causal factors and risk

Occurring spontaneously, the erosions may follow a trauma: scratches by fingernails, paper, make-up implements, foreign bodies, contact lenses, etc.

- Corneal oedema promotes the occurrence of erosive episodes
- Periodic recurrence during menstruation has been described
- Pre-existing corneal dystrophy is a risk factor

*SL: slit lamp.

References

Wood T O. Recurrent erosion. Tr Am Ophth Soc; LXXXII; 1984; 850-98. Hykin P G et al.; The natural history and management of recurrent corneal erosion: a prospective randomised trial. Eye (1994) 8, 35-40.



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Did you know...

In 1941, Dr David Cogan demonstrated the causal link between recurrent erosions and hypotonicity of the tears bathing the cornea during the night, hence the idea of applying a hypertonic solution at bedtime, to dry the cornea.



NaCl 5%

Osmotic effect⁽¹⁾

- Dehydrates the corneal tissue^[2]
- Promotes epithelial adhesion^[6]
- Prevents recurrence^[2]
- Reduces corneal oedema^[1]

HA 0.15%

Protective effect⁽³⁾

- Stabilises the tear film⁽⁴⁾
- Promotes corneal healing⁽⁵⁾



1-2 drops 4 times per day during episodes, especially in the evening at bedtime^[2].

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6. Fadlalaah A, Legeais JM, Les kératalgies récidivantes et leurs traitements cicatrisants, *Les Cahiers d'Ophtalmologie*, Tiré à part, Mai 2014.

NON-PERFORATING OCULAR TRAUMA



Pathophysiological notes

Blunt object contusions of the eyeball (caused by sport balls, champagne corks, etc.) can lead to corneal oedema. Generally, the smaller the object, the greater the damage to the eyeball is likely to be.

Contusions can affect both the anterior and posterior parts of the eye. If the endothelium is significantly damaged, there is a persistent risk of corneal oedema and bullous keratopathy.



Clinical signs and symptoms

Anterior segment:

- The extent of the oedema depends on the severity of the shock
- The cornea may present erosions and oedema in cases of severe contusion
- Conjunctival hemorrhages should trigger a search for scleral wounds or foreign bodies in the eye
- Hyphema, generally with spontaneous resolution
- Iridodialysis, post traumatic mydriasis
- Subluxation, posterior dislocation of the lens, post-traumatic cataract
- Ocular hypertension

Posterior segment:

- Retinal oedema
- Vitreous haemorrhage
- Torn retina
- Rupture of the choroid
- Very violent trauma may cause rupture of the eyeball



Therapeutic objectives

- Moderate damage to the anterior segment: reduce corneal trauma and promote healing

References

Jung-Hoon K. et al. A case of traumatic corneal stromal edema with decreased endothelial cell density. Int Med Case Rep J. 2015; 8: 133-135. Stefan M. et al. The Effect of Frontal Air Bags on Eye Injury Patterns in Automobile Crashes. Arch Ophthalmol November 1, 2002, Vol 120, No. 11, 1517-22.



- Improve visual comfort and reduce the high risk of recurrent keratalgia through the use of anti-œdematous eye drops and lubricants
- Severe contusions require specific surgical treatment, depending on loco-regional damage
- Medical treatment of hypertonicity may be considered

Anterior segment Optical Coherence Tomography and specular microscopy allow the extent of post-traumatic corneal involvement to be monitored.



Did you know...

The deployment of airbags in motor vehicles can cause severe eye injuries, especially in children seated in the front passenger seat. Understanding of this risk has improved the design of airbags, and the risk of eye damage has been much reduced in recent years.



Mechanism of action

ODM 5[®]

NaCl 5%

Osmotic effect⁽¹⁾

- Draws fluid out of corneal tissue⁽¹⁾
- Promotes corneal transparency⁽²⁾
- Improves visual acuity⁽³⁾

HA 0.15%

Protective effect⁽⁴⁾

- Stabilises the tear film⁽⁵⁾
- Promotes corneal healing⁽⁶⁾
- Improves eye comfort



Dosage

1–2 drops, 4 times per day until reduction of œdema.

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HA 0.15%

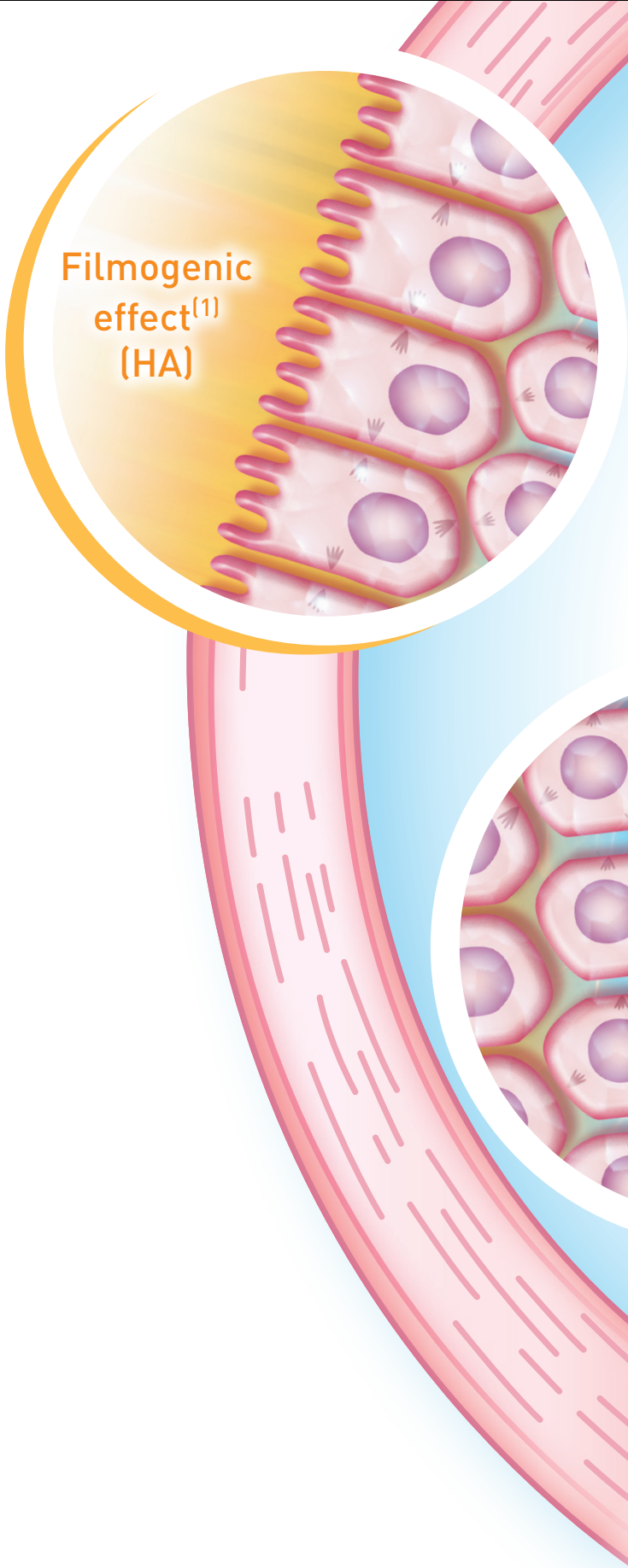
Protective effect⁽¹⁾

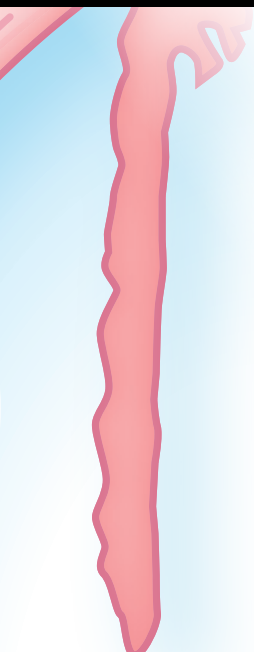
Promotes corneal
healing⁽²⁾

Stabilises the tear film⁽⁵⁾

Improves eye
comfort

Filmogenic
effect⁽¹⁾
(HA)





ODM 5[®]

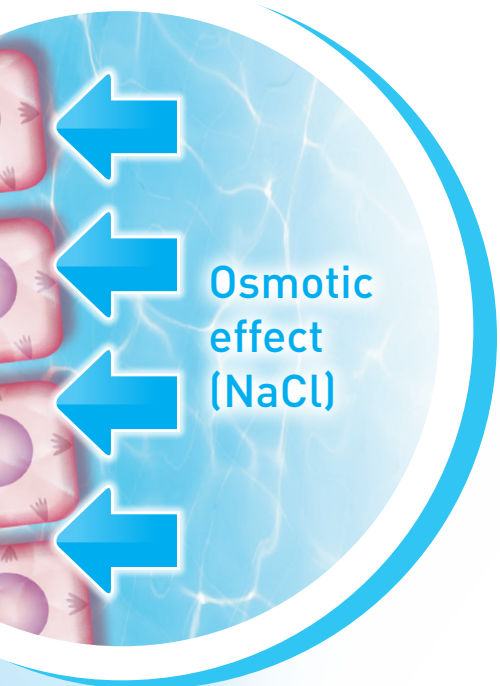
CONTRIBUTES TO IMPROVE
VISUAL FUNCTION

NaCl 5%

**Osmotic
effect⁽⁴⁾**

**Draws fluid out
of corneal tissue⁽⁴⁾**

**Improves
visual acuity⁽³⁾**



Osmotic
effect
(NaCl)

1. Debbasch C, Bruneau De La Salle S, Brignole F, Rat P, Warnet JM, and Baudouin C, Cytoprotective Effects of Hyaluronic Acid and Carbomer 934P in Ocular Surface Epithelial Cells, Investigative Ophthalmology & Visuel Science, November 2002, 43(11): 3409-15.
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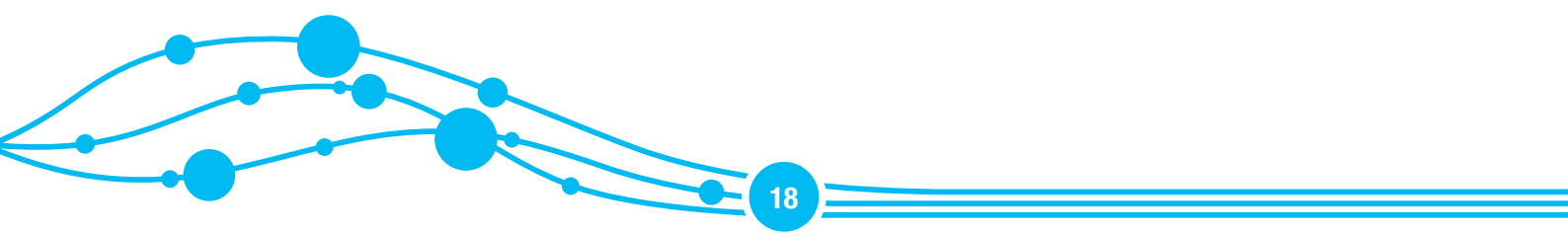
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United Kingdom
Tel: +44 (0) 1202 658 444



148, Av. G. Guynemer - 06700 Saint-Laurent du Var
Tel. No.: +33 (0)4 93 19 54 03 -
Fax: +33 (0)4 93 19 54 09
www.horus-pharma.fr

