

# AMNIOTIC MEMBRANE – A TEMPORARY SOLUTION IN CASE OF PERFORATED CORNEAL ULCER

CRISTINA NICULA<sup>1</sup>, D. NICULA<sup>2</sup>, M. BLIDARU<sup>3</sup>, LAURA STĂNILĂ<sup>4</sup>,  
SIMINA MUREȘAN<sup>5</sup>

<sup>1,2,4</sup> Optilens Clinic Cluj-Napoca, <sup>3,5</sup> UMF Cluj-Napoca

**Abstract:** We present the case of a female patient, 30 years old, who developed a perforated corneal ulcer at which we made an amniotic membrane graft as a temporary solution in order to save the eye

**Keywords:** amniotic membrane, corneal ulcer

**Rezumat:** Se prezintă cazul unei paciente cu ulcer cornean perforat, la care s-a efectuat un transplant de membrană amniotică, ca soluție temporară pentru salvarea globului ocular.

**Cuvinte cheie:** membrana amniotică, ulcer cornean

## INTRODUCTION

In 1940, Roth [7] was the first who used amniotic membrane for ophthalmic purpose.

Tseng and col. [9,10] have done recent transplantation of amniotic membrane for the management of patients with corneal defects.

The indications for amniotic membrane graft are: persistent epithelial defects, progressive corneal ulcer, painful pseudophakic keratopathy, corneal neurotrophic alteration, simblepharon, conjunctival melanoma, boluse epidermolysis (children) [3,4,5,6,8]. The amniotic membrane can also be used, but with minimal efficiency in: stem cell deficiency, Steven-Johnson syndrome, trachoma, ocular pemfigoid [1]. In this cases it is associated with limbal stem cells graft.

The clinical properties of amniotic membrane are: facilitates corneal epithelisation (migration and adhesion of epithelial cells), conservation of functional limbal cell stem, decrease of inflammation (cytokinases, proteases inhibitors), decrease of scarring process, diminish neovascularisation [2].

## PURPOSE

The purpose of the paper is to established the efficiency of amniotic membrane in a case of perforated corneal ulcer.

### History

The paper presents the case of a 30 years old female, who had a surgical intervention for a right acustico-vestibular neurinoma, two years ago. After the surgery she remained with a peripheral facial paralyses and lagophtalmy on the right eye. In time she developed a neuroparalitical keratites, having local treatment with nonsteroidical drugs (Indocolir 3x/zi), artificial tears

(Systane 2x/zi) and epithelisation drugs (Corneregel 2x/zi). The patient refuses the blepharoraphy and according with her mother's indication she instilated in this eye a drog called Tataneasa tincture. Immediately after the instillation she accuses intensive ocular pain, epiphora and blepharospasm. At the slit lamp examination we discovered a central corneal ulceration, very large, which retained the dye. We recommended continuing the local treatment with epithelisation drugs, artificial tears, nonsteroidical drugs and ocular patch. Unfortunately the evolution was to descemetocel and corneal perforation.

### Reasons for ophthalmologic consultation

These reasons consists of: worm liquid on the face, ocular pain and blepharospasm, symptoms and signs present at right eye.

### Pathological personal data

We retain the operation for the acustico-vestibular neurinoma, followed by facial paralyses.

### Ocular exam revealed

- RVA = PSL
- LVA = 1
- Ocular refraction: RE – cannot be done, LE - + 0,5
- Slit lamp examination
  - RE:
    - mixed conjuntival congestion;
    - the cornea is hypotransparent with a central corneal perforation, about 2mm, with inclavated iris at this level, surrounded with corneal edema;
    - anterior chamber is absent, the iris being pushed to the corneal endothelium
  - LE: normal anterior segment;
- Ocular fundus:
  - RE – cannot be seen;
  - LE – normal.

### Positive diagnosis

On the base of the history and ocular exam we put the diagnosis of: RE: Lagophtalmy. Perforated corneal ulcer. Exogenous acute uveitis.

### Evolution

In the absence of a correct and urgent treatment the evolution of the case is to endophtalmitis, panophtalmitis and functional and anatomical loss of the eye.

### Treatment

In this case the treatment has to be done urgent and follows the obturation of the corneal perforation. Because of the lack of the possibilities to make the corneal graft the single modality to maintain the eye is the amniotic membrane graft.

We made the prelevation of amniotic membrane from a female placenta operated by caesarian delivery with HIV, HVB, HVC, syphilis tests negative. We also made the separation of amniotic membrane by dissection after washing with cephalosporin and stored in sterile conditions.

The surgery technique consists of:

- topic anesthesia with Benoxinat;
- introduction of viscoelastic substance at the level of perforation, in order to push backward the iris (fig. 1);
- perlimbal conjunctive incision (fig. 2);
- placement of amniotic membrane with the epithelial face upward on the cornea (fig. 3);
- inseration of amniotic membrane under the bulbar conjunctiva (fig. 4);
- surget suture of the amniotic membrane to the conjunctiva with Vycril 7.0 (fig. 5);
- placement of a therapeutically contact lens;
- ocular bandage till the following day.

**Figure no. 1. Viscoelastic substance injection in the corneal perforation**



**Figure no. 2. Perilimbal conjunctival incision**



**Figure no. 3. Placement of the amniotic membrane**



**Figure no. 4. Insertion of amniotic membrane under the conjunctiva**



**Figure no. 5. Suture of the amniotic membrane to the conjunctiva**



Postoperative treatment consist of instillation of Floxal 0,3% - 3x/day, in association with Flumetol - 3x/day and Systane - 2x/day.

The evolution was favorable. In the first day after the surgery the patient didn't have any ocular pain, the amniotic membrane was on the place and the anterior chamber was small but present.

The follow up was made at 48-72h and than at every 3 days for a period of 2 month. After 3 weeks we saw the complete resorbtion of the amniotic membrane, with the total epitelisation of the corneal ulcer and the stabilization of the cornea, without inflammation. After 6 weeks, appeared a central corneal scar with a normal anterior chamber.

After one year the patient had a corneal graft in Budapest and a implantation of a golden platelet in the superior eyelid in order to diminish the lagophthalmy.

### Prognosis

The visual prognosis of the patient is strictly dependent on the presence of lagophthalmy which was not solved completely and can influence the corneal graft statement.

### Case particularities

The unfavorable evolution of the case to corneal ulcer and perforation was determined by the lack of blepharophy at the certain moment and the association of local medication of the patient, which represented the trigger.

## CONCLUSIONS

Amniotic membrane transplantation is a temporary solution in tectonic correction of corneal or conjunctival defects

**BIBLIOGRAPHY**

1. Di Pascuale MA, Espana EM, Liu DT, Kawakita T, Li W et al. Correlation of corneal complications with eyelid cicatricial pathologies in patients with Steven-Johnson syndrome and toxic epidermal necrolysis syndrome. *Ophthalmology* 2005; 112:904-912.
2. Gabric N, Mravicic I, Dekaris I, Karaman Z, Mitrovic S. Human amniotic membrane in the reconstruction of the ocular surface. *Doc Ophthalmol.* 1999; 98:273-283.
3. John T, Foulks GN, John ME, Cheng K, Hu D. Amniotic membrane in the surgical management of acute toxic epidermal necrolysis. *Ophthalmology* 2002; 109:351-360.
4. Pires RTF, Tseng SCG, Prabhasawat P, Puangsricharern V, Maskin SL, Kim JC, Tan DTH. Amniotic membrane transplantation for symptomatic bullous keratopathy. *Arch. Ophthalmol.*, 1999; 117:1291-1297.
5. Prabhasawat P, Tesavibul N et al. Efficacy of amniotic membrane patching for acute chemical and thermal ocular burns. *J.Med.Assoc.Thai.* 2007; 90:319-326.
6. Prabhasawat P, Tesavibul N, Komolsuradej W. Single and multilayer amniotic membrane transplantation for persistent corneal epithelial defect with and without stromal thinning and perforation. *Br.J.Ophthalmol.*, 2001; 85:1455-1463.
7. Roth A. Plastic repair of conjunctival defects with fetal membrane. *Arch. Ophthalmol.*, 1940, 23:522-525.
8. Tejwani S, Kolari RS, Sangwan VS, Rao GN. Role of amniotic membrane graft for ocular chemical and thermal injuries. *Cornea* 2007; 26:21-26.
9. Tseng SCG, Espana EM, Kawakita T, Di Pascuale MA, et. al. How does amniotic membrane work? *The ocular surface* 2004; 2:177-187.
10. Tseng SCG, Prabhasawat P, Barton K, Gray T, Meller D. Amniotic membrane transplantation with or without limbal allografts for corneal surface reconstruction in patients with limbal stem cell deficiency. *Arch. Ophthalmol.*, 1998; 116:431-441.

# CONTROVERSIES BETWEEN TORIC AND RIGID CONTACT LENSES FOR HIGH ASTIGMATISM CORRECTION

CATALINA CORBU<sup>1</sup> MIHAELA CONSTANTIN<sup>2</sup>

<sup>1</sup> Oftaclinic Bucharest, <sup>2</sup> Emergency Hospital of Ophthalmology, Bucharest

**Abstract:** The paper presents theoretical aspects concerning the astigmatism like cause, classification, correction by toric and rigid contact lenses. Advantages, disadvantage and practical aspects of these lenses use for correction of high astigmatism are discussed.

**Keywords:** toric contact lenses, rigid contact lenses, astigmatism

**Rezumat:** Lucrarea prezinta aspecte teoretice privind astigmatismul – cauze, clasificare, corectie prin lentile de contact torice si dure. Sint discutate avantajele, dezavantajele si aspecte practice ale folosirii acestor tipuri de lentile in corectia astigmatismelor mari.

**Cuvinte cheie:** astigmatism, lentile de contact moi, lentile rigide

- the percent of oblique astigmatism represent 20% - 25% and is invariably during life.

Astigmatism value	Percentage
> 0.25 D	76.5%
> 0.50 D	61.5%
> 0.75 D	45.4%
> 1 D	34.8%
> 1.25 D	24.8%
> 1.50 D	19.2%
> 1.75 D	15.8%
> 2.25 D	10%
> 2.75 D	6%
> 3 D	3.4%

These changes are determinate by: decrease corneal base curvature on main meridians, the horizontal base curvature is almost equal with the vertical base curvature; the physiological astigmatism disappear during life; the palpebral pressure decreases on vertical meridian – with age the collagen structure changes the rigidity and favors change with – the- rule astigmatism in against the rule astigmatism.

Correction of irregular astigmatism is different in function of Amsler classification:

- Stadium I is characterized by oblique astigmatism and is corrected with spectacles or soft contact lenses.
- Stadium II is characterized by high irregular astigmatism and is corrected with rigid contact lenses.
- Stadium III is characterized by almost impossible recorded astigmatism and sometimes is corrected with rigid contact lenses.
- Stadium IV the astigmatism is impossible recorded, corneal opacities need correction with rigid contact lenses and/or piggyback, or are not corrected.

Correction of astigmatism with soft and rigid contact lenses founds two new interfaces one between the air and the anterior surface of lens and other between the posterior surface lens and the anterior surface of tear film. The correction of total astigmatism with contact lens

## INTRODUCERE

The astigmatism represents a refraction disorder in which the light comes parallel from the infinite focus in many regular or irregular points after passing ocular diopter. Regular astigmatism presents an orderly geometrical deviation, has the principal meridians 90 degrees apart and is corrected with spectacles. Irregular astigmatism presents an disorderly deviation, the principal meridians are not 90 degrees apart and this astigmatism cannot be completely corrected with soft toric lenses.

Isac Newton described the astigmatism in 1670 for first date.

Total astigmatism represents the sum of anterior corneal astigmatism and intern astigmatism. Intern astigmatism is the sum of posterior corneal astigmatism, lens astigmatism, retinal astigmatism and optical aberrations. High astigmatism has a value higher to 2.50D and can corrected with toric soft contact lenses or rigid contact lenses. The table shows the patients distribution with astigmatism which want wearing contact lenses. We observe that almost 10% from patients have astigmatism higher 2.50D.

Holden study shows that 25% patients have an astigmatism <0.25D and 10% patients which need correction have an astigmatism > 2.75D. The same study showed that the astigmatism evolutes during life:

- the percent of with – the - rule astigmatism decrease from 75% in the first decade to 20% at fifth decade.
- the percent of against the rule astigmatism increase from 20% in the first years to 65% at 50 years old.

needs a good static and dynamic centration of contact lens without rotation on the cornea.

Correction of cornean astigmatism or mixt astigmatism is perform with soft posterior toric lens. Intern astigmatism is correct with anterior or posterior toric lens.

Soft toric contact lens is indicating for:

- astigmatism higher 1D
- intolerance at rigid contact lens
- improper correction of visual acuity with soft spherical contact lens
- raport sphere/cylinder <4/1.

The using toric contact lens for the correction of astigmatism has the following advantages: comfort – frequently is the first option for patient (studies and practices show that rigid contact lenses have the similar comfort too, after the patients were accommodated); the stability is influenced by hydrostatic, gravitational and palpebral forces, the superior side is cover by superior lid and with blinking the lid slips on contact lens without its dislocation; visual acuity is high; is possible the wearing for long time with maintain optical stability at blinking time; these contact lenses have a less influence for corneal metabolism with better tolerance; ocular injuries is rarely.

Disadvantages are represented by: fragility, short time for use, difficulties in correction of high astigmatism; hardly cleaning and disinfection with destroyer of lens; deposits on the lens (mucus, proteins); infection risk (fungi's, bacterial contamination) anything lesion at level of contact lens creates adherents situs for potential microorganism; "perfidies" lenses with a high rate ischemic or infection complications in defections using (wearing use, hygiene, ophthalmologic control); they can determine visual acuity disorder even in perfectly fitting, due to dehydration of lens, the astigmatism or the lens deposits.

Rigid contact lens gas permeable (RGPCL) apparition marked an important step in evolution of contact lenses by satisfactory contribution for corneal oxygen permeability permitting a normal corneal metabolism and decrease intolerance injures with corneal edema. There are spherical, toric and bitoric RGP. Anterior toric RGP contact lens corrects intern or mixt astigmatism. For residual astigmatism can be use bitoric RGP contact lens. Corneal astigmatism is corrected with spherical RGP contact lens and residual astigmatim is corrected by anterior toric RGP lens.

Rigid contact lens is use for:

- correction almost 90% anterior corneal astigmatism
- correction of astigmatism higher 3 D, uncorrected with soft toric lenses
- correction of irregular astigmatism
- patients with giant-papillary conjunctivitis, precarious hygiene.

Advantages for using RGP contact lenses are represented by:

- better correction for astigmatism so we have a better optic quality than soft toric lenses (patients with astigmatism higher 1D have a less visual acuity by

correction with soft lenses because these lenses adhere on corneal toric surface)

- higher and stable visual performance
- the flux of tears is permit under contact lenses and at patients with sicca syndrome maintain hydrofoils state
- durability
- easy maintenance.

Disadvantages are representing by: long time for adaptation, shorter time of tolerance, optical instability in blinking time, easy dislocation, higher risk for loosing, frequently blinking, palpebral ptosis, ocular irritation. For irregular astigmatism, sometimes unrecorded, with K medium >60D is indicating to use piggyback technique which has the following advantages:

- better comfort
- good centration
- lower loosing risk
- protection for the apex.

Disadvantages of this technique are representing by manipulation and maintenance for two lenses and higher price.

We present six cases with high astigmatism corrected with contact lens.

### Case 1:

Male patient, 25 years old with refraction RE : - 3.25 sph <> -3.75 cyl ax 42. UCVA for RE is 0.3. BCVA for RE with toric lens is 0.7 with -2.25 cyl ax 40 and by RGP contact lens (7.5/-2.25/9.85) is 10/10.

### Case 2:

Male patient, 17 years old, with refraction at RE: -2.25 sph <> -3.50 cyl ax 15. UCVA RE is 0.05. BCVA RE is 1.0 with toric lens -2.50 sf <> -2.25 cyl ax 10

### Case 3:

Male patient with keratoconus, 21 years old with refraction at LE: -1.50 sph <> -8.50 cyl ax 158. UCVA LE is 0.1. BCVA LE is 0.7 with RGP contact lens 7.6/-3/10.0

### Case 4:

Male patient with keratoconus has refraction at RE: -4.50sph <> -9.50 cyl ax 14 and LE: -2.25 spf <> -8.50 cyl ax 165 UCVA RE is 0.05. BCVA RE is 0.8 with RGP 7.1/-6.50/10.0. UCVA LE is 0.1 BCVA LE is 1 with RGP 7.4/-3/10.0

### Case 5:

Male patient 17 years old with refraction at RE: +3.25 sph <> -5 cyl ax 23. UCVA RE is 0.05.

BCVA RE is 0.5 with toric lens -2.25 cyl ax 20; uncorrected with RGP contact lens.

### Case 6:

Female patients, 16 years old has refraction at RE: +4 sph <> -4 cyl ax 18. UCVA RE is 0.1 BCVA with toric lens +1 sph<> -1.75 cyl ax 20 is 0.6; uncorrected with RGP contact lens.

## CONCLUSIONS

Soft toric and rigid contact lenses are a solution for correction high astigmatism, the option of patient has

been major importance in choosing.

Rigid gas permeable contact lenses are preferred physiologic for long wearing fitting by high transmissibility of oxygen. Improvement of visual acuity with this kind of lens for patient with keratoconus is an evidence of diagnosis confirmation.

Correction of astigmatism with soft toric lens is easier, but these must have higher oxygen permeability and frequently there change. In cases with hyperopia refraction, visual acuity is correct with toric contact lens.

### **BIBLIOGRAPHY**

1. Chaudhry M., Contact Lens Primer 2007
2. Pavan Langston D., Manual of ocular Diagnosis and Therapy 2002, 398-430.
3. Malet F., Les Lentilles de contact 2009, 373 – 461.

# THE CROSS – LINKING TECHNIQUE IN CORNEAL PATHOLOGY

CRISTINA NICULA

*Optilens Clinic Cluj-Napoca*

**Abstract:** Cross – Linking (CXL) is a photopolymerization of the stromal fibrillas, in order to increase their stiffness and resistance to the keratectasia, through the combined action of a photosensitizing substance (riboflavin and Vitamin B2) with the irradiation of ultraviolet light performed with an illuminator in a solid state of UVA kind (18). The main objective is to slow down or arrest the progression of keratoconus, avoiding, or at least delaying the necessity of keratoplasty.

**Keywords:** cross-linking, keratoconus

**Rezumat:** Cross – Linking (CXL) este un proces de fotopolimerizare al fibrelor stromale corneene, în vederea creșterii rezistenței și rigidității corneene, prin acțiunea combinată a substanței fotopolimerizante – riboflavina - și a radiației ultraviolete eliberată de un aparat special - CMB X LINKER (18). Obiectivul tehnicii de cross-linking a fost de a încetini sau stopa progresia keratoconusului, astfel evitând sau cel puțin întârziind necesitatea transplantului corneean.

**Cuvinte cheie:** cross-linking, keratoconus

## Definition

Cross – Linking (CXL) is a photopolymerization of the stromal fibrillas, in order to increase their stiffness and resistance to the keratectasia, through the combined action of a photosensitizing substance (riboflavin and Vitamin B2) with the irradiation of ultraviolet light performed with an illuminator in a solid state of UVA kind (18).

## History of Cross – Linking

CXL was developed from 1993 till 1997 by Gregor Wollensak, Theo Seiler and Eberhard Spoerl (University of Dresden, Germany) (19). First patients treated in 1998.

## Objective of Cross – Linking

The main objective is to slow down or arrest the progression of keratoconus, avoiding, or at least delaying the necessity of keratoplasty.

The rationale of the procedure is supported by the fact that very few young diabetic patients are affected by keratoconus (17).

In the rarest of occasions, pre-existing development of keratoconus before the onset of diabetes does not show any progression due to the natural cross-

linking effect of glucose (chemical cross-linking) (21).

## The principle of Cross – Linking

Photopolymerization using the UV-light was found to be the most promising technique to achieve cross-links in connective tissue.

Photopolymerization is activated by means of a non-toxic and soluble photomediator and a wavelength which is absorbed strongly enough to protect deeper layers of the eye (riboflavin) (3).

## Mechanism of Cross – Linking

UV-A radiation with administration of riboflavin – dextran solution as a photosensitizer, represent the trigger of the mechanism. After the combining action singlet oxygen and superoxide free radicals are liberated and the physical CXL of the corneal collagen fibers is done.

Intrahelical and interhelical cross-links can be formed within or between the tropocollagen units that comprise the individual collagen fibrils. Intermicrofibrillar cross-links can form between adjacent collagen microfibrils that comprise the collagen lamellae. This goes to slow down of thinning and increase strenght of cornea (25).

## Biomechanical changes in the cornea after Cross – Linking

Andreasson and col. (2) showed in their studies that the biomechanical strenght of the cornea is abnormally low in keratoconus. Elsheikh and Hadley and Krueger and Seiler (7,8,12,17) have demonstrated that keratoconus rarely occurs in instances where corneal stiffening is increased by enhanced collagen CXL (elderly, diabetes).

The basis of enhanced biomechanical strength in cornea after CXL consist of the formation of covalent cross-links and interaction of free radicals with aminoacids in neighbouring collagen molecules after the combined action of the photosensitizer : riboflavin applied on the desepithelized surface of the cornea and exposure to UV-A light (25).

It was not yet demonstrated if the cross-links are confined to collagen or they occur nonspecifically in tissue.

Theoretically the collagen fibers surfaces are too widely separated to allow direct interfibrillar linkages. Corneal collagen associates with other bridging collagens

and proteoglycan molecules which determine indirect interfibrillar cross-linking via these molecules (26).

Müller and col. (15) showed in a study made on sheep cornea that cross-linked corneas swell less than normal. Their results were that riboflavin – dextran reduce the sheep corneal thickness up to 17% in 35 minutes of exposure. They couldn't explain if the resistance to stromal swelling in CXL – treated corneas is due to presence of dextran or indirect interfibrillar CXL.

Wollensak and col. (25) demonstrated that CXL halts the progression of keratoconus and even a slight regression. Braun and col. (3) studied the corneal rigidity after CXL, showing that there is a decrease in corneal elasticity after riboflavin / UVA CXL (contact ultrasonic device). Luce and col. (13) established that corneal hysteresis is an indicator of corneal viscoelasticity (Ocular Response Analyzer). Albe (1) and Zadok (26) demonstrated in their studies in ovine cornea that CXL increases corneal hysteresis. In the same time it was shown that biomechanical measurements may be influenced by changes in parameters during CXL (thickness + hydration).

Spoerl and col. (19) measured the biomechanical stress – strain from cross-linked corneas. Other authors (22,23) showed stiffening following treatment and increase in corneal rigidity with 320% in humans.

In long term follow up the stiffening effect is maintained over 8 months (22,24). In time long term durability of the strengthening effect appeared (24).

### **Advantages of Cross – Linking**

The advantages of Cross – Linking are: easy to perform, noticeably reduced time of procedure, localized-selective treatment, lack of scarring, availability of riboflavin, non-toxic and hydrosoluble, good stromal penetration. Cross – Linking technique is safe. Riboflavin can decrease of about 95% the UVA light intensity, allowing to remain below the endothelium cytotoxic threshold for corneal thickness > 440 micron (<0.36 mW/cm<sup>2</sup>). The riboflavin role consist of: absorption and concentration of the UV radiation, is the photosensibilizing agent for the production of a kind of reactive oxygen and gives endothelial protection. The riboflavin 0.1% solution contains dextran T500 20% which maintains the osmolarity, avoiding corneal soaking and swelling during the treatment.

### **Known risks of Cross – Linking**

The Cross – Linking technique gave no side effects for the corneal endothelium, lens and retina. Post surgery the patient complained of pain and feeling of foreign body for 24 – 48 hours, till reepitelization is complete and hyper-tearing for 24-72 hours. Transitory corneal edema with visual haze for 30 – 60 days was seen. The treatment does not exclude the possibility of keratoplasty.

### **Does Cross – Linking promote artificial aging ?**

CXL increases corneal stiffness and resistance to enzymatic digestion (18,20). In the same time CXL alters cornea's behavior under thermal, hydrostatic and electrophoretic stress (20), but the exact magnitude of its

clinical effects cannot be quantified.

Marshall and col. (14) studied 9 corneas who underwent epithelial debridement alone. Other corneas had epithelial debridement and CXL and others epithelial debridement and CXL with glutaraldehyde 10%. The results showed the increase in corneal stiffness linear with age. The corneal young's modulus increased 4,3 times so that CXL ages the cornea 600 years in aprox. 600 seconds.

### **Types of Cross-Linking**

There are 4 types of Cross-Linking:

1. Enzymatic Cross-Linking (the natural collagen Cross-Linking)
2. Chemical Cross-Linking (glutaraldehyde, formaldehyde)
3. Photochemical Cross-Linking (UVA rays, ionizing radiations)
4. Photooxidative Cross-Linking (riboflavin-UVA)

### **Indications of Cross-Linking:**

1. keratoconus:
  - progressive keratoconus in younger patients, patients with early diagnosis or slightly older patients showing refractive instability (increasing astigmatism or myopia – topographical analyses);
  - established keratoconus and intolerance of hard contact lenses (CXL improve the shape of cornea for better contact fitting)(4);
  - recurrent keratoconus after penetrating keratoplasty (24);
2. pellucid marginal degeneration;
3. post LASIK ectasia (4) ;
4. bullous keratoplasty (16);
5. corneal melting and ulcers (5);
6. pathologic myopia (10,11).

### **Contraindications of Cross-Linking:**

1. corneal pachymetry under 400 µm;
2. central corneal scars;
3. Vogt striae;
4. epithelial healing disorders such as map dot dystrophy and rheumatism disorders;
5. refractive radial keratotomy;
6. previous herpes simplex virus keratitis\_(UV-A may induce herpes reactivation);
7. pregnancy.

### **Ocular examination before Cross-Linking:**

The ocular examination before Cross-Linking starts with the discussion with the patient about CXL (Preoperative Councillng). It has to give the following information to the patient :

- the goal of CXL is not a refractive endpoint;
- additional chair time and patience;
- explain the technique, its effects (limits further progression);
- spectacles or CL still be required;
- can continue their lifestyle + jobs;
- postoperative course (haze, pain, delay in epithelisation, infection, sterile infiltrates, tear dysfunction);
- RGP – removed 2 weeks before CXL;



- vit.C (antioxidant) – discontinued 1 week before CXL in patients with atopic eye disorders or poor tear function;
- the effect of CXL – may take 3 - 6 months;
- note a slightly loss of BCVA.

The ocular examination consists of:

- UCVA, BCVA;
- ocular refraction;
- keratometry (must be less than 60D);
- corneal topography (Pentacam);
- pachymetry (at least 400  $\mu$ );
- counting of endothelial cells

### Technique of Cross-Linking:

#### a. The standard protocol:

- sterile opening in the surgery room of the ophthalmic solution of riboflavin 0,1% - dextran 20%;
- verification of the power of the illuminator UVA array in a solid state CBMX linker with a UVA power meter;
- topical anesthesia (alcaine) – 3-4 drops, 15-20min before CCL;
- removal of the corneal epithelium 9mm of diameter;
- instillation of a drop of alcaine;
- instillation of riboflavine 0,1% every 3 min for 30min before the irradiation;
- corneal irradiation of central 9mm through the CMBX linker + instillation of riboflavine 0,1% every 3min – 30min;
- instillation of ofloxacin + indocolyre;
- TCL for 3-4 days

#### b. The modified protocol:

##### b1. In thin corneas (advanced progressive keratectasia)

In this protocol is used the hypoosmolar riboflavine solution 0,1% (9) (does not contain dextran). After the removal of the epithelium it is instilled this solution till the width of cornea is 400  $\mu$ m. After that the technique is similar as in the standard protocol.

##### b2. Transepithelial tensioactive mediated Cross-Linking (Protocol of Roberto Pinelli).

In this protocol is used the riboflavine that contains benzalkonium chloride (BAK). The solution is applied directly onto the intact epithelium. The mechanism of BAK is to change the surface tension in order to allow riboflavine to penetrate the cornea. The advantages are: less invasive, fewer complications, increased patient comfort (6).

### Postoperative management:

The therapeutic contact lenses are applied for 4-5 days. The patient will use local antibiotic, steroids and lubricants for 4-6 weeks. The check up is at 28, 48 hours and at day 4 or 5 to remove the contact lens. The follow up is at 6 weeks, 3, 6, 9, 12 months after CXL.

### Results of Cross-Linking in Keratoconus

Concerning the topography, the frontal apical elevation showed a significant reduction starting from the 2nd month after surgery (25). The spherical aberration and high orders doesn't show statistically significant variations. The coma aberration is highly reduced from the first month after CXL.

Regarding the keratometric values there is a regression of aprox. 2D in 70% of patients (18,24) after 3-6 months from CXL. Other authors (21) revealed a mean K reduction of 2.1D.

About the refractive errors they were reduced with 1,14D (20). Spoerl and col. (18) showed a reduction of spherical equivalent of 2,5D.

The pachymetry (ultrasonic pachymetry) showed a little increase in the first month (because of the postoperative corneal edema) and after 3 months no significant changes were observed (23).

The visual acuity with and without correction improved in 68% (21), with one or two Snellen lines at 3 months, even if the procedure is not a refractive one.

Cross-Linking offers the stability of the cornea. For visual rehabilitation (after 6 months) we can associate a therapeutic partial topography-guided PRK on cross-linked cornea (3) or intracorneal rings. Both this methods normalizes the corneal surface by reducing irregular Astigmatism, and potentially the refractive error as well.

### Cross-Linking in bullous keratoplasty (BK)

For a normal activity, cornea needs a normal endothelial pump function. No endothelial pump function gives swelling of the cornea and fluids accumulates in extracellular spaces between the collagen fibers and lamellae (16).

The principle of CXL in BK is the concept of stromal compaction with enhanced resistance to osmotic and hydrostatic fluid accumulation (12).

### Cross-Linking in corneal ulceration and melting

The principle of Cross-Linking in this severe keratitis is to increase resistance to collagenase, pepsin, trypsin digestion, especially in the anterior half of the cornea (the biochemical effect of CXL).

Spoerl and col. (19) showed in Cross-Linked pigs eyes the doubling of the digestion time of enzyme.

### Cross-Linking in pathologic Myopia

The principle of CXL in high Myopia is to change in the biomechanical weakened sclera.

Wollansek (22) and Iseli (10) studied the CXL made on the sclera in living rabbit eyes. The results showed an increase in stiffening.

### Take home messages

1. The biomechanical strength of the cornea is abnormally low in keratoconus patients, which may play a role in the progression of the disease.
2. CXL may hold the progression of keratoconus, by strengthening individual corneal collagen fibers.
3. CXL ages the cornea 600 years in approximately 600 seconds.
4. Uses of CXL are multiplying: keratoconus, pellucid marginal degeneration, postlasik ectasia, bullous keratopathy and pathologic myopia.
5. Modified treatment parameters for CXL may be used in patients with advanced keratectasia who can still achieve satisfying visual acuity with contact lenses.
6. Hypoosmolar riboflavin solution can be used to increase corneal depth in corneas too thin for standard protocol.

7. The treatment must prevent damage to the corneal endothelium, iris, lens and retina.
8. Simultaneous surface ablation with CXL produces topographic improvements and visual rehabilitation.
9. ICRS regularize the front surface of the cornea by building tissue in the mid-periphery.

**REFERENCES**

1. Albe E. Measuring corneal biomechanical properties in keratoconic eyes undergoing crosslinking. *Cataract and Refractive Surgery Today Europe* 2008;5;33-34
2. Andreasson TT, Simonsen AH, Oxlund H. Biomechanical properties of keratoconus and normal cornea. *Exp Eye Res* 1980; 312:435-444
3. Braun E, Kanellopoulos J, Pe L, Jankov M. Riboflavin/Ultraviolet-A-induced collagen cross-linking in the Management of Keratoconus. *Invest Ophthalmol Vis Sci*.2005; 46:4964
4. Charters L. Numerous risk factors found for corneal ectasia after Lasik. *Ophthalmology Times* .Aug 1,2007
5. Corkin R., CXL Indications and Patient Selection. *J Cataract Refract Surg*.2009;04;32-33
6. Elshawaf HI. TCXL Trasepithelial corneal cross-linking. Paper presented at the IV International Congres of CXL December 5-6 2008 Dresden Germany
7. Elsheikh A, Brown M, Alhasso D, Rama P, Campanelli M, Garway-Heath D. Experimental assessment of corneal anisotrophy. *J Refract Surg*.2008; 24;178-187
8. Hadley JC, Meek KM, Malik NS. The effect of glycation on charge distribution and swelling behaviour of corneal and scleral collagen. *Invest Ophthalmol Vis Sci*. 1996;37; S1010.
9. Hafezi F, Mrochen M, Iseli Hp, Seiler T. Collagen Cross Linking with UVA and hypoesmolar Riboflavin solution in thin corneas. *Cataract Refract Surg*.2009;04;32-33
10. Iseli PH, Spoerl E, Wiedermann P, Krueger RR, Seiler T. Efficacy and safty of blue light scleral cross-linking. *J Refract Surg* 2008;24:752-755
11. Krachmer JH, Feder RS, Berlin MW. Keratoconus and related noninflammatory corneal thinning disorders. *Surv Ophthalmol*1984;28:293-322
12. Krueger RR, Ramos-Esteban JC, How might corneal elasticity help us understand diabetes and intraocular pressure? *J Refract Surg*. 2007; 23;85-88
13. Luce DA. Determining in vivo biomechanical properties of the cornea with an ocular response analyser. *J Cataract Refract Surg*.2005;31;156-162
14. Marshall J, Knox-Cartwright N., Does CXL Promote Artificial Aging. *J. Cataract Refract Surg*.2009;04;22-23
15. Muller L, Pels E, Vrensen G. The specific architecture of the anterior stroma accounts for maintenance of corneal curvature. *Br J Ophthalmol*.2001; 85; 437-443
16. Rao GN, Aquavella JV, Goldberg SH, Berg SL. Pseudofakic bullos kerathopathy. Relation ship to preoperative corneal endothelial status. *Ophthalmology* 1984; 91:1135-1140
17. Seiler T, Huhle S, Spoerl E, Kunath H. Manifest diabetes and keratoconus: A retrospective case-control study. *Graefes Arch Clin Exp Ophthalmol*. 2000; 238:822-825
18. Spoerl E, Huhle M, Seiler T. Induction of crosslinks in corneal tissue. *Exp Eye Res*. 1998;66;97-103
19. Spoerl E, Wollensak G, Seiler T. Increased resistance of crosslinked cornea against enzymatic digestion. *Current Eye Research* 2004;24:35-40
20. Spoerl E, Wollensak G, Dittert DD, Seiler T. Thermomechanical behaviour of collagen cross-link porcine cornea. *Ophtalmologica* 2004; 218:136-140
21. Wollensack G, Spoerl E, Seiler T. Riboflavin/Ultraviolet A induced collagen cross linking for treatment of the keratoconus. *AM J Ophthalmol* 2003;135;620-627
22. Wollensak G, Iomdina E. Long-term biomechanical properties of rabbit cornea after photodynamic collagen cross-linking. *Acra Ophthalmol*.2009;87;48-51
23. Wollensak G, Spoerl E, Seiler T. Stress –strain measurements of human and porcine corneas after riboflavin –ultraviolet –A-induced cross linking. *J Cataract Refract Surg*.2003;29;1780-1785
24. Wollensak G, Wilsch M, Spoerl E, Seiler T. Collagen Fibril diameter in the rabbit cornea after collagen cross-linkung by riboflavin/UV-A. *Cornea* 2004; 23;503-507
25. Wollensak G. Crosslinking treatment of progressive keratoconus; new hope. *Curr Opin Ophthalmol* 2006;17(4);356-360
26. Zadok D, Goldich Y, Barkana Y, Rasko A and Avni I. Influence of UV-A-riboflavin corneal collagen cross-linking on biomechanical properties of keratoconic eyes. Paper presented at the 2008 ASCRS annual Meeting ; April 4-9 2008; Chicago

# CORRECTION OF PRESBYOPIA WITH CONTACT LENSES

DANIELA GOICEA

Medicover, Bucharest

**Abstract:** Population ageing is an issue in all the developed European countries. Romania encounters a special situation, due to reaching the presbyopic age of people born after the Decree 770/1966 banning abortions, which resulted in doubled natality next years. On the other hand, about 20 years ago the first contact lenses started to enter on the Romanian market. Those who shifted to contact lenses at that moment became or will soon become presbyops. Therefore, is appropriate to be prepared to offer a solution to presbyops who do not want to wear glasses.

**Keywords:** presbyopia, monovision, multifocal contact lenses

**Rezumat:** În toate țările europene dezvoltate se vorbește despre îmbătrânirea populației. În România există o situație aparte legată de ajungerea la vârsta prezbiopiei a celor născuți în urma decretului de interzicere a avortului (770/1966), care a avut ca rezultat dublarea natalității în anii următori. Pe de altă parte, în urma cu aproape 20 de ani pătrundeau pe piața românească primele lentile de contact. Cei care au început atunci să le poarte au devenit sau vor deveni curând prezbiopi. De aceea, este bine să fim pregătiți să oferim o soluție prezbiopilor care nu doresc să poarte ochelari.

**Cuvinte cheie:** presbiopia, monovision, lentile de contact multifocale

- Does not compromise the view in low lighting or blunt contrast.
- Minimal compromise in near vision performance – may be recommended to those with strong near vision demands.

### Disadvantages

- Loss of stereo acuity, especially for high additions.
- Loss of contrast and difficulty in suppressing bright images on dark background.
- Some patients can not adapt due to difficulties in suppressing one eye.
- Problems can appear in depth perception.
  - o Drivers have to be warned.
  - o Can be solved by wearing glasses over CL.
- Compromises the vision at very far and very near (difficulties for several activities: night driving, playing golf, reading for long time).

### Partial monovision

Is recommended when presbyopia advances, as the add exceeds +2.00D and the monovision is not accepted anymore. The addition has to be reduced on the eye corrected for near and the sub-correction has to be compensated with supplementary glasses for small print. In addition, glasses for distance can be supplementary recommended for driving. Such correction may be suitable for patients who need especially better intermediate vision.

### Multifocal contact lenses

Bifocal and multifocal contact lenses are based on two types of design: alternating vision and simultaneous vision

### Alternating vision lenses

Similar to bifocal glasses, the lens has 2 distinct areas – one superior for distance vision and other inferior for near vision. For distance vision, the patient looks straight and is seeing through the superior part of the lens. In downward gaze for reading, the lens is pushed upward by the inferior lid and the patient looks through the inferior part of the lens, which contains the addition for near. The stability of the lenses is obtained through bottom thickness (prism ballast), truncating or both.

### Simultaneous vision lenses

The zones for distance, intermediate and near vision are disposed concentric in front of the pupil, the image of any object being formed throughout all optical

## INTRODUCERE

### Contact lenses

### Monovision – an acceptable compromise ... for some patients

Monovision is the correction for distance in one eye (usually the dominant eye), and for near in the other eye. It is based on the principle that the visual system selects the clear image at the desired distance, alternating the central suppression between the 2 eyes when the viewing is alternating between distance and near targets. The success of fitting depends on the degree of suppression, which varies from patient to patient. The rate of success of monovision is between 67 and 86 %.

### Benefits

- Easy to prescribe.
- All kinds of contact lenses (spherical/toric, various materials) can be used.
- Is not related to pupil size.

zones. When a distance object is fixed, the optical zone for distance produces a focused image, while a blurred image is produced on the retina through the near zone. The visual system is able to select the clearer desired image and to ignore the others.

The performance of the lens depends on the pupil size and on the lens centration.

There are three types of design for simultaneous vision: multi-zone concentric, diffractive and aspheric.

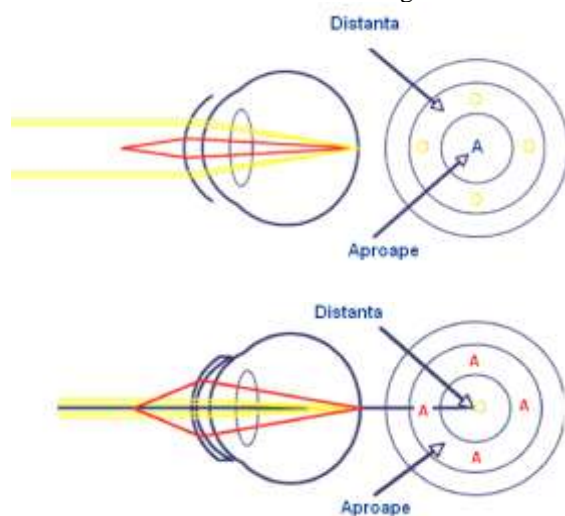
#### Multi-zone concentric design

There are several alternative concentric zones for distance and near vision. The quality of vision at any distance depends on the quantity of light entering the eye through the distance or near zones. The quantity of light is regulated by pupil dimension. It favors distance vision in extremely bright or in very reduced light. In ambient illumination a more equal light distribution through distance and near zones is provided.



#### Aspheric design

Addition powers are concentric and gradually change from geometric center through the edge of optical zone. There are 2 types of aspheric design – centre-near and centre-distance. There is an issue related to the centre-distance lenses due to the fact that at near vision the pupil is constricting, blocking thus the vision through the periphery, which is actually meant for near vision. Such problem is solved by the centre-near design. The two multifocal Silicon hydrogel lenses available on Romanian market have centre-near design.



#### Prescription of multifocal lenses

##### A. Refraction

##### 1. Determining the distance power

The distance power is determined through an as careful as possible refraction and choosing the least minus

or most plus.  $\pm 0.25\text{Dsph}$  may affect patient vision and satisfaction. We have to take into account that at this age the hyperopia is slightly increasing. Over-correction of myopia or sub-correction of hyperopia may lead to a higher-than-necessary add power.

The distance power of multifocal lens is determined applying the correction for vertex distance of the spherical equivalent. An astigmatism higher than

1. Dcyl. should not be ignored because it adds to high aberrations.
  2. Determining the addition
  3. Determining the dominant eye (for example through  $+2,00\text{Dsph}$  test)
- B. Trial with multifocal contact lens
- Allow the lenses to settle about 10 minutes.
  - Evaluate the fitting with the slit-lamp (centration, movement).
  - Check binocularly the distance and near vision, under normal room illumination.
  - Over-refract with hand-held trial lenses. The phoropter should be avoided as it affects the near accommodative response and pupil size.

#### Improving distance vision

- Increase the minus in distance lens power
  - By  $-0.25\text{Dsph}$  in dominant eye or both eyes
  - Check subjective and objective improvement to distance vision
  - Check that near vision remain unchanged or acceptable
  - Continue to add minus power if further distance vision improvement is confirmed, while near vision does not alter
- Reduce add power – in one or both eyes
- “Modified monovision“
- “Enhanced monovision”

#### Improving near vision

- Increase the plus in distance lens power
  - By  $+0.25\text{Dsph}$  in non-dominant eye or both eyes
  - Check subjective and objective improvement to near vision
  - Check that distance vision remain unchanged or acceptable
  - *Adding plus power only to non-dominant eye may reduce the risk to alter the distance vision, meanwhile improving near vision*
- Increase add power
- “Modified monovision“
- “Enhanced monovision”

#### Modified monovision

It consists in fitting multifocal lenses in both eyes, but with the aim to improve distance vision in one eye (at the expense of near performance) and near vision in the other. Improving distance vision on the dominant eye is achieved by increasing the minus / decreasing the plus for distance power, decreasing the addition or choosing the centre-distance design. Improving near vision on the non-dominant eye is achieved by increasing the plus / decreasing the minus for distance power, increasing the addition or choosing the centre-near design.

### Enhanced monovision

It consists in fitting one eye with a single-vision distance lens (usually in the dominant eye), and the other with a bifocal or multifocal lens. Such correction is useful for patients fitted with multifocal lenses, which are not satisfied by the distance vision, as well as for monovision wearers who need high additions, with the aim to improve stereoacuity. Seldom, may be recommended a single-vision near lens on the dominant eye and a bifocal or multifocal lens on the other eye for patients interested especially in the near view.

### Patient approach

An interesting idea is to approach the patient before presbyopia appears, according to Sarah Morgan: "It's not what we tell our presbyopic patients, it's what we tell our PRE-presbyopic patients that counts. Forecasting their vision future promotes confidence and places the eye care professional as a visionary – and an authority on vision. Explaining presbyopia to patients is the first step and discussing it, before presbyopia strikes, is prudent."

After presbyopia appears, we should present to the patients all correction modalities, enhancing their benefits and limits, and recommend the appropriate option for each one. Presenting all the options, they can not say "nobody told me this".

Practitioners who are successful in fitting multifocals state that the communication is essential. Here are some advices:

- Be enthusiastic!

Mention multifocal lenses to every possible candidate! You may say: "Did you know that there are contact lenses which allows you to see at near without glasses?"

- Be optimistic!

"Wearing contact lenses is the "secret" way to see at all distances, while looking all around."

- Establish realistic expectations!

"Multifocals improve the vision and **reduce** the need for glasses." The patient should know that contact lenses will help in usual activities – viewing a cell-phone, working on computer, reading newspapers – but might be situations in which glasses will be of help.

- Offer a "test drive"

Encourage the patient to test the vision with multifocals in day-by day life. The patient should wear the lenses about one week, after which they should come back for adjustments. State that afterwards you can improve the initial prescription, which was only a starting point. Insist that they should wear the lenses during trial period, scoring the quality of near and distance vision.

### CONCLUSION

There are now various options to correct prebyopia with contact lenses. The new simultaneous vision lenses, comfortable and with increased optical performance are easy to fit, and the availability of single-use diagnostic trial lens allows the patients to experiment and to enjoy their advantages.

### BIBLIOGRAPHY

1. Nathan Efron, Contact lens practice, Reed Educational and Professional Publishing Ltd 2002
2. Mile Brujic, Tips from the Trenches, Review of Cornea and Contact Lens, 2009
3. Sarah Morgan, Presbyopia happens, CIBA VISION, 2009
4. Kathryn Richdale, Ocular and Refractive Considerations for the Ageing Aye, CLSpectrum, 2009
5. Jane Schofield, Multifocal contact lenses – from opportunity to success, Dispensing Optics, 2009
6. Dimple Shah, Life Begins at Presbyopia, Academy for Eyecare Excellence, 2009

## THERAPEUTIC CONTACT LENS IN THE ANTERIOR POLE SURGERY COMPLICATIONS

ADRIANA STĂNILĂ, A. TEODORU, ELENA MIHAI, MIHAELA FLORESCU,  
V. RUSU, I. COSTACHE

Ocular Surface Research Center Sibiu, Emergency Hospital Sibiu, "Lucian Blaga" University Sibiu

**Abstract:** Aim Of Study: this study reveals some complications of the anterior pole surgery where the use of therapeutic contact lenses (TCL) proved to be of great benefit. Material, Method: We used TCL for the management of wound dehiscence (after cataract surgery) and excessive filtration (after glaucoma surgery). Results, discussions: The small wound dehiscences after cataract surgery (through small incisions for phacoemulsification) were solved within a few days using only a TCL, without re-suturing the wound. The excessive filtration after glaucoma surgery turned to normal using TCL. The applying of LCT in bullous keratopathy reduced significantly the symptoms in all cases. Conclusions: The using of TCL in these cases offer new and simple solutions for the management of nearly common complication encountered after anterior pole surgery.

**Keywords:** therapeutic contact lens, anterior pole surgery  
**Rezumat:** Scopul lucrării: studiul evidențiază unele complicații ale chirurgiei polului anterior în care lentila de contact terapeutică s-a dovedit eficientă. Material, metodă: am utilizat LCT în dehiscențe de plagă după operația de cataractă, în situațiile cu exces de filtrare după chirurgia glaucomului și în keratopatia edemato-buloasă. Rezultate, discuții: dehiscențele mici după chirurgia cataractei (facoemulsificare) s-au rezolvat pozitiv în câteva zile după aplicarea lentilei. Excesul de filtrare după operația de glaucom s-a normalizat folosind LCT. Simptomatologia s-a ameliorat în keratopatia edemato-buloasă prin aplicarea de LCT. Concluzii: folosirea LCT oferă o soluție nouă și simplă la unele complicații aparute în urma chirurgiei de pol anterior.  
**Cuvinte cheie:** lentila de contact terapeutică, chirurgia polului anterior

### AIM OF STUDY

This study reveals some complications of the anterior pole surgery where the use of therapeutic contact lenses (TCL) proved to be of great benefit.

### MATERIAL AND METHOD

We used TCL for the management of wound dehiscence (after cataract surgery), excessive filtration (after glaucoma surgery), edemato-bullous keratopathy.

### RESULTS AND DISCUSSIONS

The small wound dehiscences after cataract surgery (through small incisions for phacoemulsification) were solved within a few days using only a TCL, without re-suturing the wound.

We studied a group of 570 patients hospitalized in the Department of Ophthalmology Clinic of the Emergency Hospital Sibiu during 2007 - 2008, with the diagnosis of cataract.

All cases were operated using the extracapsular extraction of the cataract by phacoemulsification.

4 cases (0,70%) presented wound dehiscence in the first postoperative day (small anterior chamber, without iris in-clavation).

2 cases were related with thermal injury of the main incision, the correlation being statistic significant ( $p < 0,05$ ).

In all cases we applied a therapeutic contact lens (fig. 1). No surgical intervention was required.

Figure no. 1. TCL in wound dehiscence



In 3 cases with excessive filtration after glaucoma surgery we applied TCL (2007-2009). The filtration turned to normal using TCL in few days and the anterior chamber became normal (fig.2)

Pain and foreign body sensation in bullous keratopathy are due to the rupture of the vesicles formed in the cornea because of the endothelial dysfunction.

Applying of LCT in the cases with bullous keratopathy reduced significantly the symptoms (fig.3).

**Figure no. 2. TCL in excessive filtration after glaucoma surgery**

Treatment of eye Disease, 3rd edition, Lippincot, Williams& Wilkins, 1999, pg 61-63,67,112



**Figure no. 3. LCT in bullous keratopathy**



### CONCLUSIONS

- The using of TCL in these cases offer new and simple solutions for the management of nearly common complication encountered after anterior pole surgery.
- The thermic injury of the wound was statistic corelated ( $p < 0,01$ ) with postoperatory wound dehiscence. We demonstrated that small dehiscences can be successfully solved by applying a TCL without suture.
- Excesive filtration after glaucoma surgery can be managed with TCL.
- The symptomatology of EBK regresses under the protection of the lens.

### BIBLIOGRAPHY

1. Ryan R.A. Rochester O.D. -23rd Annual Contact Lens Report, 2000;
2. Stanila A. - Oftalmologie ,Ghid practic, Ed Imago Sibiu, 2000, pg 72-74, 115
3. Kanski J.J. – Clinical Ophthalmology, 5-th Edition, 2003, 405;
4. Douglas J. Rhee, Marc F. Pyfer- The Wills Eye Manual: Office and Emergency Room Diagnosis and

## APLICAȚII ALE LENTILELOR DE CONTACT TERAPEUTICE

SIMONA RADU

SC Euro-Optics SRL, București

**Abstract:** Therapeutic contact lenses are special contact lenses worn for the treatment of corneal or anterior eye diseases and injuries. They are primarily used for pain relief and increase of comfort, assistance of wound healing, mechanical protection, maintenance of ocular surface hydration and as a vehicle for drug delivery. The use of plano or powered contact lenses may also preserve or enhance vision in injured eyes. Therapeutic lenses are particularly useful for post surgical management of the patients (pterygium, cataract and glaucoma surgery; keratoplasty; refractive surgery; collagen cross linking; amniotic membrane) as they allow the cell growth and adhesion to take place without interference from the blinking eyelids and also protect the eyelids from irritations caused by sutures. The materials used for therapeutic contact lenses are hydrogels, silicone elastomers, collagen, and gas permeable polymers in the form of scleral lenses. Soft lenses are preferred because of the large diameter, supple nature, low movement amplitude and enhanced comfort. Hydrogel lenses, however, dehydrate on the eye and the relatively low Dk may induce hypoxia, as therapeutic contact lenses are used in the continuous mode. Silicone hydrogel lenses, available since 1999 and approved for therapeutic use, became the first choice because of very high oxygen transmissibility, lower on-eye dehydration and good comfort and coverage of the eye surface.

**Keywords:** therapeutic contact lenses, silicon-hidrogel materials

**Rezumat:** Lentilele de contact terapeutice sunt definite ca lentile de contact folosite în tratamentul unor afecțiuni și traumatisme oculare. Ele au ca efecte principale: reducerea durerii și creșterea confortului, asistarea reparării tisulare, protecție mecanică, menținerea hidratării suprafeței oculare și rezervor de substanțe medicamentoase. Pot avea și rolul de a menține sau îmbunătăți vederea. Lentilele terapeutice sunt incluse și în cadrul protocolului postoperator în cazul anumitor afecțiuni și complicații chirurgicale (pterigion, chirurgie cataractei și a glaucomului, keratoplastii, chirurgie refractivă, collagen crosslinking, transplant de membrană amniotică) deoarece permit creșterea și adeziunea celulelor corneene fără interferența clipitului și protejează pleoapele de iritațiile cauzate de firele de sutură. Materialele folosite sunt diverse: hidrogel,

elastomeri siliconici, collagen, polimeri gaz permeabili în forma de lentile sclerale. Lentilele moi sunt în general preferate datorită diametrului mare, supleții, mobilității reduse și a confortului superior. Lentilele din hidrogel însă se deshidratează în timpul purtării, iar transmisibilitatea la oxigen este relativ scăzută și pot induce hipoxie, mai ales că sunt folosite în regim continuu. Lentilele din silicon hidrogel, disponibile din 1999, au devenit prima opțiune datorită înaltei transmisibilități la oxigen, rezistenței la deshidratare și bune acoperiri a suprafeței oculare, în condiții de confort.

**Cuvinte cheie:** lentile de contact terapeutice, materiale silicon-hidrogel

### INTRODUCTION

Therapeutic contact lenses are special contact lenses worn for the treatment of corneal or anterior eye diseases and injuries. The lenses are used in continuous wear modality, variable periods of time between days and months, years maybe, handling being performed by specialist only and are generally associated with topical medication.

Today practitioners may choose between more sophisticated materials (1)(with higher oxygen transmissibility –RGPs and silicon-hydrogels), improved lens designs and lens care and replacement options (2), things that lead to a greater success with therapeutic lenses in a wide range of anterior segment pathologies.

Also there are new refractive surgery techniques that include therapeutic contact lenses in their protocol. .

#### Functions of the TCL

We are fitting the therapeutic lens to serve one main purpose, but the functions are generally associated.

- Pain relief

Epithelial lesions are very painful and induce lacrimation, photophobia, blepharospasm and severe cases present even anterior inflammation, causing chemosis and limbal redness. During blinking, the superior eyelid movement enhances the discomfort. The lens alleviates pain better than patch.

- Mechanical protection

The lens protects the sensitive corneal surface during blinking, especially in tear film deficiencies (high friction, lid wiper epitheliopathy) or in cases of post



traumatic or recurrent corneal erosions.

Lenses can be used in lid deformities or scars that affect their shape or movement with/without exposure keratopathy, in trichiasis or cranial nerves palsies, till surgical treatment.

We can also use therapeutic soft lens in the piggy-back system in advanced cases of keratoconus, to protect the tip of the cone from the friction induced by RGP lens.

After certain surgical procedures (eg. Keratoplasty), the contact lens can be used to diminish the irritation of the upper lid because of the sutures or the uneven host-graft junction.

- Promotion of the wound healing

The contact lens protects the wound area from the interference of the lid during blinking and allows rapid coverage of the defect and strong adhesions between cells and to the basal membrane.

High oxygen transmissibility and low on-eye dehydration maintains the normal physiology of the corneal tissue

- Maintenance of corneal epithelial hydration

Severe dry eye is a common contraindication for contact lens wear, because of intense on-eye dehydration, mostly in soft hydrogel contact lenses.

However, in certain situations, like Filamentary Keratitis in Sicca Syndrome, contact lenses can be used to maintain corneal hydration. Best performance can be obtained with low water content silicone-hydrogel lenses or scleral RGPs with high oxygen transmissibility, used together with lubricant drops.

- Structural support

In cases of acute thinning of the cornea, like Descemetocel, contact lenses can be used as an alternative to the suture of the eyelids.

- Sealing of corneal perforations

The use of TCL in perforating injuries of the cornea can eliminate or lower the number the sutures and reduce the suture-induced astigmatism. Best results in very small punctures or flaps.(3)

- Drug delivery ( collagen shields, soft lenses)

The contact lens can maintain the drugs on the corneal surface and reduce the number of applications of medication. Frequent replacement and use of preservative-free drops is advisable.

- Improving visual acuity

Usually therapeutic lenses are produces as „plano”, but they can improve visual acuity in distorted corneas, (RGP, silicon-hydrogel special designs) or in those cases where spectacles are not allowed because of facial injuries.

- Restoring the binocular vision

In small injuries, the use of contact lenses instead of a patch, preserve vision in monofthalm patients and restores binocular vision for the others.

### **Ocular diseases where we can use TCLs for pain relief**

#### **Bulous Keratopathy**

Decompensation of the corneal endothelium in posterior corneal dystrophies or after surgery causes

corneal oedema and epithelial bulae and painful erosions. Pain I will be reduced by a steep fit of the therapeutic lens (4) The TCL wear may be continued indefinitely or just till penetrating keratoplasty, so the selected TCL should have a high oxygen transmissibility to reduce the risk of vascularisation.(5)

Thygeson superficial punctate keratitis

In severe cases, the TCL is used as a pressure patch, for relieving pain and foreign body sensation.

#### **Filamentary keratitis**

Filaments are common in severe dry eye cases but also after keratoplasty or vitrectomy in diabetics. For persistent cases, TCLs can be used, filaments are showing resolution in 4 days and disappearance in 2 weeks, but they can recur. Patients should receive additional intense lubrication and be closely observed because of the higher risk of infection of this cases.

### **Ocular diseases where we can use TCLs for promoting wound healing**

#### **Recurrent corneal erosions**

This painful episodes of epithelial erosions occur most often after trauma (linear cuts, foreign bodies), in anterior membrane dystrophies (10 %) or even spontaneously in cases with favorables factors like dry eye or diabetes. Disposable, steep and thick TCLs used for 2-6 month may help to formation of healthy strong adhesion between cells and epithelial basement membrane.

Persistent corneal epithelial defects after burns or neurotrophic keratopathies (viral infections in late stages, tumors, radiotherapy, vascular disesses in trigeminal area) can be managed by TCLs or collagen shields until new epithelium reattaches to the newly secreted basement membrane.

Herpes simplex is a contraindication for TCL use in acute stages but it can be fitted weeks later for persistent epithelial defects caused by toxicity of antiviral medication or neurotrophic keratitis (6)

Exposure keratopathy as a cause of facial palsies or lid defects may benefit by temporary TCL with intense lubrication

Descemetocel may lead to perforation and TCL may be used as an alternative to the suture of the lids, with topical medication (7)

### **Ocular diseases where we can use TCLs for protection**

Steven-Johnson syndrome may benefit from TCL use in late stages for preventing symblefaron formation and corneal protection. Scleral lenses, large (15-20mm) thick soft lenses or silicone materials are of choice.

#### **Severe dry eye**

On short term, silicon ruber lenses and scleral RGPs mai be used for filamentary keratitis

Lid deformities with exposure keratitis, entropion, trichiasis may be managed by a TCL till surgical treatment is performed

In advanced cases of keratoconus, piggy-back system is an option because it helps to protect the

sensitive apex of the cornea and to stabilise the RGP for a better vision.

### **Surgical conditions that may appear in cases of ocular trauma or surgical procedures**

#### **Trauma**

In corneal abrasions TCLs may be used, instead of patch, for injuries over 4 mm in size

Corneal lacerations, especially non-infected, limbal wounds have better recovery and less vascularisation when a steeper, big diameter and with high oxygen transmissibility contact lens is used (8)

Corneal perforations may be easily sealed by using a TCL with or without cyano-acrylate glue, before or instead of sutures. In central injuries less astigmatism is induced.

#### **Chemical burns**

TCL may inhibit the passage of certain proteolytic enzymes present in the tear film to the stroma, thus preventing the progressive ulcerative process

For peripheral defect low water content soft lenses may stimulate vascular ingrowth and arrest the ulcerative process.(9) When the lids are also involved, a scleral lens is of choice .

In alkali burns - scleral lenses and very large soft lenses help prevent simblefaron in later stages . (10)

#### **Pterygium**

After surgical removal of pterygium, TCL reduces pain, promotes corneal epithelisation and on long term may reduce the number and severity of recurrences by controlling the conjunctival progression towards cornea during healing.

#### **Cataract**

First day postsurgery some unsutured small incisions may show positive Seidel. TCL may be used for few days to stop the leak and seal the wound.

#### **Glaucoma**

Excessive postoperative drainage of the bleb may benefit of large TCL (TD 16-20 mm) until the anterior chamber is completely restored.

#### **Keratoplasty**

Surgeons are using TCLs after perforating or lamellar keratoplasty for improving the comfort of the patient and protect the palpebral conjunctiva from abrasion caused by the sutures but also in cases that present delayed epithelial healing, epithelial filament formation, steps in host – graft junction, loose sutures. In these cases lenses are used for pain, protection, healing and hydration.

#### **After vitrectomy**

Diabetics develop epithelial defects after vitrectomy in about 25% of the cases, so a TCL may promote healing. TCLs should have high oxygen transmissibility, used in association with topical antibiotics and be followed closely because of the higher risk of infection in these patients,

#### **Refractive surgery**

PRK and LASEK include TCLs in their routine, as they promote healthy wound-healing by preventing corneal desiccation, particularly when surface ablation

leaves the stroma bare – within 4 days.

LASIK procedure may be followed by TCL fit in case of complications like: thin flaps, free flap, button-hole, lacerations.(11)

**Collagen cross linking with UVA and Riboflavin A** as a treatment for keratoconus progression and postsurgery ectasia is also using TCLs for pain control and promotion of healing.

#### **Ocular surface reconstruction with amniotic membrane**

Amniotic membrane is a tissue used for reconstruction of the ocular surface. TCL may be used to cover the membrane and to allow the cell growth and adhesion to take place without interference from the blinking eyelids and protect the palpebral conjunctiva. The membrane may be held in place by a smaller number of sutures and has a longer therapeutic action.

#### **Contact lens materials**

##### **Hydrogel lenses**

Soft contact lenses have been preferred for therapeutic use because their soft and flexible nature and large variety of parameters that allow a simple and comfortable fit to any distorted ocular surface. As they have a permeable structure they maintain the concentration of topical associated drugs for longer periods of time with a less frequent instillation regime.(12)

There are a big number of hydrogels available, starting from the original Otto Wichterle's formula - Polyhydroxyethylmethacrylate (p-HEMA) 38% water content- by adding different monomers: acid methacrylic (AM), N-vinyl pyrrolidone (NVP), poly vinyl pyrrolidone (PVP), poly vinyl alcohol (PVA) to improve oxygen permeability and biocompatibility.

According to the water content we have 3 groups in the European classification :Low water content 38-45% ,Mid-water content 45-55% and High water content 67-80% and

In US there are four groups, as they take into consideration the water content and ionic charge: Group I: Non - ionic, LWC; Group II: Non - ionic, HWC; Group III: Ionic, LWC; Group IV: Ionic, (HWC: > 50 % water, Ionic : > 0.5 % Methacrylic Acid)

Oxygen permeability is linked to the water content and to the thickness so the best oxygen transmissibility is delivered by the thin medium water content lenses, but it does not exceed the values needed for safety values even for daily wear ( $Dk/t = 24$  for no corneal edema -Holden & Mert, and  $Dk/t = 35$  for absence of corneal anoxia -Harvitt & Bonnano). When the eye is closed these values are much bigger ( $Dk/t = 87$ , respectively  $Dk/t = 125$ .)

(The labeled value of  $Dk/t$  is for the central area -3,00D lens, at 35 °C) (13)

As therapeutic lenses are used in extended wear modality, hydrogels may induce corneal hypoxia and neovascularisation and affect corneal physiology.

During wear, hydrogel lenses dehydrate up to 6% of their water content that induces a steeper fit in time and

an osmotic stress to the ocular surface. Therefore the lens should be evaluated again in 20 minutes after insertion.

Ionic materials attract more proteins on their surface and non-ionic materials are showing more lipid deposition.(14)

**Extra thin glyceryl methacrylate lenses** (Crofilcon) are known to have a smaller rate of giant papillary conjunctivitis.(9)

**Silicone elastomer lenses** were used for their extremely high oxygen transmissibility and much less vascularisation, mostly in children afakia. The hydrophobic nature of the material induces heavy lipid deposits and they tend to stick to the ocular surface.

### **Silicone- Hydrogel materials**

First models have been introduced in 1999 (Lotrafilcon A and Balafilcon A ) and very soon they received FDA approval for therapeutic use for maximum 30 days of continuous wear.

Advantages of this combination are: high permeability to oxygen , water and sodium, therefore a high oxygen supply to the cornea, as a result the hypoxic stress in overnight wear is dramatically reduced; flexibility; lower water content with a low dehydration during wear and a stable post lens tear film; good surface wettability achieved by surface treatment (by plasma coating or oxidation) and less deposits ( some lipid, non-allergenic depositions).

There are still some disadvantages: limited parameters (relatively small diameter), concurrent medication should be non-preserved, and risk of complications associated with extended wear (microbial keratitis, infiltrates). Modulus has also relative high values so the incidence of inflammatory reactions is relatively high (infiltrates, papillary conjunctivitis, superior epithelial arcuate lesions) despite availability of different base curves for better fit. (15) Surface treatment is also expensive.

Since 2004 other products have been released on the market, some with internal wetting agents (eg. Galyfilcon A, Senofilcon A) (16) or with natural wetting macromer combination (Comfilcon A, Enfilcon A) that eliminate the need for surface treatment and one with the same coating but lower modulus (Lotrafilcon B)

Some of this products ghave received approval for extended wear up to 7 days and 6 nights (lotrafilcon B, senofilcon A) or continuous wear for 30 days and nights (Comfilcon A).

The advantages of the new generations are improved flexibility and wetability without surface treatment so the production ad replacement costs diminished.

**Rigid gas permeable lenses and scleral lenses and rings**, with high oxigen transmissibility, may be used for therapeutic purpose, in specific cases where we need prevention of simblepharon formation, maintainance of corneal hidration and on distorted corneas. The disadvantages are the initial discomfort and longer time for fitting.

Collagen shields may be also used as corneal

bandage. They are made of bovine or porcine collagen, have a Dk/t equivalent of a 63% water soft lens, mai be soaked in antibiotics, and they last for 12,24 or 72 hours, as they biodegrade on eye.

### **Instrumentation**

For therapeutical contact lens fit instrumentation is simple: slit-lamp (examination should be performed in difuse or lower light intensity because of photophobia), dyes (Fluoresceine, rose bengal, lissamine green), Schirmer test, keratometer (measurmet of the fellow eye), topography (for RGPs). Anesthetics should be used only in small amounts.

**Selection of therapeutic contact lens** should be made according to the specific disorder, oxygen transmissibility, parameter range, parameter stability, wettability of surface, lubricity, deposits (non -ionic hidrogel and silicone hydrogel attract more lipids, build-up is liniar in timp but do not induce allergies)(14), modulus, costs.

### **Fitting of the lens**

The lenses should be fitted with great care fore good corneal coverage and mobility.

With intact epithelium or corneal oedema fit should be normal to loose, for good tear exchange

For pain relief or in cases where epithelium is not intact or topography is irregular, steep fit is better, achieved by increasing lens diameter or reducing the base curve of the lens. Edge design of soft lens has a major impact on mobility.

Fit should be assessed in 20 min and again in 60 min to unmask the dehydration effects.

**Aftercare** is minimum, patient should be compliant and follow doctors recomandations regarding hygiene, local treatment and check-up schedule. Follow-up will be performed at 24h, 72h, 1 week, 2weeks, and monthly, according to the case. Lenses should be replaced at 1 week or 1 month.

**Complications** of therapeutic contact lenses are the same as for all contact lenses: corneal edema, corneal vascularisation, corneal infiltrates, staining, deposits, giant papillary conjunctivitis, hypopyon, infection. Risk is even higher as lenses are used in extended wear modalities, topical steroids may be associated and immune system or the patients may be compromised (diabetes). Associated topical drugs should be preservative free or the lens should be discarded weekly, to avoid toxicity.

There are patient-related risks: severity of disease, dry eye, topical steroids, compliance, hygiene, general health, motivation and lens-related risks: hypoxia, deposition, mechanical insult, poor fit, extended wear that have to be taken into consideration when fitting and monitoring a TCL.(17)

## CONCLUSIONS

TCLs are offering great benefits in the treatment of ocular surface pathology.

Soft lenses are preferred because of the large diameter, supple nature, low movement amplitude and

enhanced comfort. Hydrogel lenses, however, dehydrate on the eye and the relatively low Dk may induce hypoxia, as therapeutic contact lenses are used in the continuous mode.

Silicone hydrogel lenses, available since 1999 and approved for therapeutic use, became the first choice because of very high oxygen transmissibility, lower on-eye dehydration and good comfort and coverage of the eye surface.

- Properties. *Optician* June 3, 2005; 229:6004 39-41
16. Morgan & Brennan, The decay of Dk? *Optician* 2004, 227(5937): 27-33
17. Schnider et al. A next generation silicone hydrogel lens for daily wear. *OPTICIAN*, 2004; 228: 5958

### BIBLIOGRAPHY

1. Coral –Ghanem C, Ghanem VC, Ghanem RC, Therapeutic contact lenses and the advantages of high Dk materials, *Arq Bras Oftalmol* 2008 Nov-Dec, 71(6Suppl):19-22
2. McDermott ML, Chandler JW, Therapeutic use of contact lenses, *Surv Ophthalmol*, 1989, Mar-Apr 33(5):381-94
3. Foulks GN, Harvey T, Raj CV, Therapeutic contact lenses : the role of high-Dk lenses, *Ophthalmol Clin North Am.* 2003 Sep;16(3):455-61.
4. Shah C, Raj CV, Foulks GN.,The evolution in therapeutic contact lenses. *Ophthalmol Clin North Am.* 2003 Mar;16(1):95-101, 1
5. Montero J, Sparholt J, Mély R, Long B.,Retrospective case series of therapeutic applications of lotrafilcon a silicone hydrogel soft contact lenses. *Eye Contact Lens.* 2003 Apr;29(2):72-5.
6. Ozkurt Y, Rodop O, Oral Y, Cömez A, Kandemir B, Doğan OK. Therapeutic applications of lotrafilcon a silicone hydrogel soft contact lenses.,*Eye Contact Lens.* 2005 Nov;31(6):268-9.
7. Kanpolat A, Uçakhan OO.,Therapeutic use of Focus Night & Day contact lenses. *Cornea.* 2003 Nov;22(8):726-34.
8. Bendoriene J, Vogt U. ,Therapeutic use of silicone hydrogel contact lenses in children, *Eye Contact Lens.* 2006 Mar;32(2):104-8
9. Ambroziak AM, Szaflik JP, Szaflik J., Therapeutic use of a silicone hydrogel contact lens in selected clinical cases.,*Eye Contact Lens.* 2004 Jan;30(1):63-7.
10. Rubinstein MP. , Applications of contact lens devices in the management of corneal disease,*Eye.* 2003 Nov;17(8):872-6.
11. Gong X, Zhong X, Yang X, Wang M. ,The study of the therapeutic application of PV contact lens, *Yan Ke Xue Bao.* 2005 Jun;21(2):67-9, 81.
12. Lim L, Tan DT, Chan WK., Therapeutic use of Bausch & Lomb PureVision contact lenses. *CLAO J.* 2001 Oct;27(4):179-85
13. Arora R, Jain S, Monga S, Narayanan R, Raina UK, Mehta DK, Efficacy of continuous wear PureVision contact lenses for therapeutic use. *Cont Lens Anterior Eye.* 2004 Mar;27(1):39-43.
14. Jones et al, *Optom Vis Sci* 2000; 77: 503-510
15. Osborn K & Veys J , A new silicone hydrogel lens for contact lens-related dryness Part 1 – Material

## BANDAGE CONTACT LENSES FOR RECURRENT CORNEAL EROSIONS

SIMONA RADU

FIACLE, SC Euro-Optics SRL, Bucharest

**Abstract:** Recurrent Corneal Erosions (RCE) syndrome is a condition that is characterized by a disturbance at the level of the corneal epithelial basement membrane, resulting in defective adhesions and recurrent breakdowns of the epithelium. It may appear secondary to corneal injury (after trauma or surgery) or spontaneously, in cases with predisposing factors, such as corneal dystrophies, diabetes, dry eye. Management of RCE may be medical treatment (lubricants, ointments, patch, bandage contact lenses etc) but also a variety of surgical procedures are recommended. Aim of the paper: to evaluate the success of therapeutic contact lenses in the management of recurrent corneal erosions. Material and Method: 27 cases of recurrent corneal erosions (2006-2009). 20 of them (macroform cases) were fitted with silicone-hydrogel TCL (moderate steep fit) used for 1-3 months, associated with preservative free lubricants. Discussions and results: Recurrent erosions were posttraumatic (16), anterior basement membrane dystrophies (3), dry eye (6), secondary to microbial corneal ulcer (1) and kerato-conjunctivitis (1). There were no complications (no infection, no infiltrates, no neovascularisation). Conclusions: The success of this simple procedure depends on cause of the recurrent erosions, associated factors, type and fit of TCL, long-term use, proper patient education. The use of the therapeutic bandage lenses is a useful and simple way to treat recurrent corneal erosions in any non-surgical ophthalmological unit.

**Keywords:** Recurrent corneal erosions, therapeutic contact lenses

**Rezumat:** Sindromul de eroziuni corneene recidivante (ECR) este o afecțiune caracterizată printr-o deficiență a membranei bazale a epiteliului cornean ce are ca rezultat o aderență scăzută și soluții de continuitate recurente ale epiteliului. Apare cel mai frecvent după un traumatism cornean (accidental sau chirurgical) sau spontan dacă există factori predispozanți cum ar fi distrofiile corneene, diabetul, ochiul uscat. Tratamentul eroziunilor corneene recidivante poate fi medical (lubrefianți, unguente, pansament compresiv, lentile de contact terapeutice sau chirurgical. Scopul lucrării: De a evalua succesul utilizării lentilelor de contact terapeutice în tratamentul eroziunilor corneene recidivante. Material și metodă: Analiza retrospectivă a 27 de cazuri de eroziuni corneene recidivante, în perioada 2006-2009. În cazurile cu alterări epiteliale vizibile (20), s-a utilizat timp de 1-3

luni o lentilă de contact din silicon-hidrogel, adaptată strâns, asociată cu lacrimi artificiale fără conservanți. Rezultate și discuții: 16 dintre eroziunile recidivante au apărut posttraumatic, 3 cazuri prezentau distrofii de membrană anterioară, 6 cazuri ochi uscat moderat sau sever, un caz a fost secundar unui ulcer cornean și altul unei kerato-conjunctivite. Nu au existat complicații (infecții, infiltrate sau vase de neoformație). Concluzii: Succesul acestei proceduri simple depinde de cauza eroziunilor recurente, factorii asociați, tipul lentilei de contact terapeutice și modul de adaptare, utilizarea ei pe o perioadă mai lungă de timp, educarea pacientului. Lentilele de contact terapeutice se dovedesc eficiente în tratamentul eroziunilor corneene recidivante și sunt ușor de folosit în orice unitate oftalmologică non-chirurgicală. **Cuvinte cheie:** Eroziuni corneene recidivante, lentilă de contact terapeutică

### INTRODUCTION

**Recurrent Corneal Erosions (RCE) syndrome** is a condition that is characterized by a disturbance at the level of the corneal epithelial basement membrane, resulting in defective adhesions and recurrent breakdowns of the epithelium.(1)

Improper healing of epithelial basement membrane or inadequate hemidesmosomes formation and adhesion to the stroma results in epithelial loss, microcysts, and bullae.

Multiple recurrences are common because the basal epithelial cells require at least 8-12 weeks for regenerating or repairing the epithelial basement membrane and pain is the most disturbing symptom.

#### Causes

1. Secondary to corneal injury. Most cases occur after accidental trauma (especially wounds with sharp edges or with foreign bodies), burns or corneal ulcers.(2) Surgical procedures like refractive surgery, vitrectomy may be followed by improper healing of the basal membrane of the epithelium. Long term use of topical medication like antibiotics, anesthetics, by their own toxicity or by preservatives may deteriorate the ocular surface balance
2. Spontaneously. Recurrent corneal erosions may occur spontaneously in cases with predisposing factors, such as: corneal dystrophies, diabetes, dry eye. 2% of the population develop anterior membrane dystrophies out of which 10% experience repeated

episodes of corneal erosions.(3)

### Management of RCE

- Medical treatment. Generally we treat corneal erosions by lubricants, ointments, sodium chloride 5%, pressure patch, bandage contact lenses sometimes with punctal closure.(4,5,6)
- Surgical treatment. There are many surgical options(7) in the treatment of recurrent corneal erosions, more or less invasive some of them using sophisticated tools:
  - Epithelial debridement (mechanical/alcohol)
  - Diamond burr polishing of the Bowman layer
  - Anterior stromal puncture
  - Nd:YAG laser treatment for Bowman layer
  - Excimer laser phototherapeutic keratectomy

### AIM OF STUDY

To evaluate the need and the success of therapeutic contact lenses in the management of recurrent corneal erosions

### MATERIAL AND METHOD

Retrospective analysis of 27 cases of recurrent corneal erosions, between 2006-2009.

In all cases patients were evaluated by careful anamnesis, refractometry, VA, biomicroscopy with fluoresceine in all cases and rose bengal in one case, BUT and Schirmer test.

#### Treatment

In cases without visible epithelial defect, were recommended lubricants, ointments at bed-time and dietary supplements (omega 3 fatty acids, vitamin A)

Where epithelial defect was present the patient was fitted with disposable bandage contact lenses, silicon-hydrogel material, continuous wear: Lotrafilcon A, available in 2 base curves (8,4 and 8,6) and Balafilcon A (8,6), with no anesthetic drops. Topical treatment used - artificial tears preservative free. In cases where epithelium was loose it was removed by debridement with a sterile cotton-tip stick prior to contact lens insertion.

Check-up was done next day, in one week and monthly.

### DISCUSSIONS AND RESULTS

Age of the patients was between 9 and 76 years old with an average of 42. were females and only 3 men. In 3 cases there were bilateral, alternative episodes. 16 of the cases had a history of trauma (paper-cut, fingernails, foreign bodies, burns), one of which showed later signs of finger-dot dystrophy, 3 anterior basement membrane dystrophies, 6 cases had moderate and severe dry eye, (2 cases had thyroid disease with substitution medication), one was secondary to a microbial corneal ulcer and one had a history of 6 months of medication after microbial conjunctivitis.

7 cases (from the posttraumatic and dry-eye groups) presented the **microform**, showing one of the following: no epithelial defect, rug appearance of the epithelium, punctate staining, pseudodendrites.

All of them complained about pain in the morning when they woke up, seconds to minutes, and tearing, with no visual loss.

The **macroform** cases presented :erosions, loose epithelium, grey opacities, LIPCOF 2, lid wiper epitheliopathy (1 case).

Symptoms were diverse : foreign body sensation, burning to severe pain – hours to days, tearing and blurred vision

**Therapeutic contact lenses** were fitted (without anesthetic drops) in macroform cases, in 2 of them after mechanical epithelium debridement. The desired fit was moderate steep. Topical associated treatment was in all cases preservative free lubricants. Lenses were used for 1 to 3 months, replaced monthly in office.

After TCL removal the patients were instructed to use preservative free lubricants several times during day-time and ointment at bed-time.

### Complications

In these cases we had NO infection, NO infiltrates, NO neovascularisation.

Some of the cases showed mild lipid deposition, due to the nature of the contact lens material.

2 cases needed refit in the second day because discomfort persisted and epithelium did not seem to heal fast enough. The steeper lens fitted showed better performance.

In 5 cases (3 with corneal dystrophies and 2 with Dry eye syndrome) there were recurrences after 4 to 6 months.

### CONCLUSIONS

The success of this simple procedure depends on the cause of the recurrent erosions, associated factors, type of TCL, long-term use, proper patient education. The therapeutic lens should have high oxygen transmissibility, low on-eye dehydration, good wettability, high lubricity. The optimum fit for recurrent erosions is moderate steep.

Therapeutic bandage lenses are useful and simple to use tools for treating recurrent corneal erosions in any non-surgical ophthalmological unit

The eye specialist must be familiar with contact lens fitting and aftercare

Education of the patient is very important in these cases due to the unpredictable nature of the episodes

### BIBLIOGRAPHY

1. Cernea Paul *Tratat de oftalmologie Editura medicala Bucuresti* 2002 pg 304-322
2. Management of Ocular, Orbital and Adnexal Trauma, ed Thomas C.Spoor and Frank A. Nesi Raven Press, New York, 1988, Chapter 3 Corneal Trauma pg 51-68
3. Reinecke Robert D *Recurrent Corneal Erosions Diagnostic and Management Ophthalmology Annual* 1989 Raven Press New York, pg 65-93
4. Shah C, Raj CV, Foulks GN., *The evolution in therapeutic contact lenses. Ophthalmol Clin North Am.* 2003 Mar;16(1):95-101

## ANNUAL CONGRESS OF THE ROMANIAN CONTACT LENS ASSOCIATION

---

5. Rubinstein MP., Applications of contact lens devices in the management of corneal disease, Eye. 2003 Nov;17(8):872-6.
6. Coral –Ghanem C, Ghanem VC, Ghanem RC, Therapeutic contact lenses and the advantages of high Dk materials, Arq Bras Oftalmol 2008 Nov-Dec, 71(6Suppl):19-22
7. Pavan- Langston Deborah, Manual of Ocular Diagnosis and Therapy Fifth Edition 2002 by Lippincot Williams & Wilkins , Philadelphia USA pg 31-37, 67-130

## PREZERVATIVES IMPACT OVER THE CORNEA

ELIGIA – MIRELA CIBOTARU

Bistrita-Năsăud Hospital

**Abstract:** The cornea sensibility represent one of the most important defense reflexes of the body. This is the modality of keeping the functional and anatomical integrity of this membrane, which has a special role in seeing proces.

**Keywords:** cornea, preservatives

**Rezumat:** Sensibilitatea corneei reprezinta unul dintre cele mai importante reflexe de aparare ale organismului. Prin aceasta se pastreaza integritatea anatomica si functionala a acestei membrane cu un rol deosebit in realizarea vederii.

**Cuvinte cheie:** corneea, conservanti

### INTRODUCTION Corneal anatomy

Anatomically, cornea is an optical, transparent membrane of the former segment of the eye, which present a series of stratify structures, different as origin, construction and refraction index.

The medium diameter is about 12mm at human people, the surface is of 1,3 cm, that means 7% from the entire externe surface of the eye.

Cornea has a central thickness of about 0,53mm with an increase of 50% around. The differences depend on the histological particularities of the ratia between corneal sections, kind, age and the normal curve.

#### Corneal histology

Histologically, cornea has 5 parallel sections:

- anterior epithelium cover by a thin liquid section – the precorneal film;
- Browman anterior limiting membrane;
- corneal stroma;
- posterior Descemet membrane;
- endothelium.

Up to the corneal epithelium surface, smooth and shinny at uzual exam, but presenting microvillosity, there is a precorneal film. Its thickness is about 7-9 microns and its role is optical, nutritional and lubricant.

#### Eyedrops

Eyedrops are sterile pharmaceutical products, used in treatment and diagnose of eye sickness. They can be solutions, emulsions or suspensions and are using like drops – instillation – in the conjunctival bag. Conjunctiva, beeing very vascularized, with a capilar system full in anastamozis, make the conection with anterior ciliar system, which means is the main place of absorbtion.

The drugs absorbtion in the eye depend of:

- solubility;
- ph;
- tampon system used;
- superficial pressure.

The eyedrops must realize some conditions, such as :

- to be clear;
- to have the same osmotic pressure like the tear liquid;
- to provide the physical-chemical stability of active principles and adjuvants;
- to have the same ph with the tears ( 7,4 – 7,8 );
- to have a good physiological tolerance;
- to be sterile;
- to be absolute pure.

The eye can support solutions with a ph between 6,5 – 9,5 because of neutral action of tears, which is a tampon system, and of spontaneons weeping.

In ophthalmology the substances used for their preservatives role must have some qualities:

- a longer spectrum of actions;
- a fast and long-term action;
- a good tolerance at used doses;
- to be compatible with joint substances and soluble;
- to be thermostabile and preservational;
- to have an anti-bacterial action in large limits of ph.

In the last few years there were published more conclusions and chimical studies about preservatives, especially benzarkonium chloride, which suggest an important role of these in topical toxicity of the eye drops, when they are used for long-term treatments.

#### The detergents effects

Most of preservatives are basically detergents. Quaternary ammonium salt has the biggest citotoxic risk. It has a hydrophobic positive strong charged heed, which permite the anchoring at membranes level. Ionical interactions break-up the lipidic balance of plasma membranes. In this way the preservatives can generate canals of acces for ionic substances in intra and intercells spaces. These effects are enough to make damages at epithelial cells level and entering the fluid in excess at stroma's level to hydrate and make the corneal oedema.

The preservatives in higher concentrations can produce cellular lisa, solving membranes by the a detergent effect. In small concentrations may prevent intercells



interactions, which are vital for cells life.

### **Grounds for concern**

The prolonged use of eye drops containing preservatives can cause allergic or inflammatory reactions, either immediate or delayed:

- burnings;
- foreign body sensation;
- hyperaemia;
- superficial punctate keratitis, especially in the lower part of the cornea.

The toxicity of ophthalmic solutions which contain preservatives may generate modifications of tear film, damage of corneal-conjunctival epithelium and also a higher permeability on epithelial level.

It can be noticed a chronic inflammatory reaction and conjunctival fibrosis, sometime extended through trabecular level, at patients under long time treatment, in addition with antiglaucoma drugs.

### **Inflammation and the tear film**

The tear film has a protection and nutritional role, most important for a healthy eye surface. The interruption of the lipidic component, low stability and the solubility are the primary adverse effects induced by using preservative products, especially those which contain quaternary ammonium salt.

The "detergent" effect can produce a faster evaporation of the tear film and also an aggravation of a pre-existing sicca syndrome.

Nuzzi et al. shows that, using for 3 months of benzalkonium chloride to patients without ocular diseases, can produce ocular and conjunctival changes with the same intensity as to the open angle glaucoma's patients, being under long-term treatment. Instillation of one single drop, with 0,01% concentration, of benzalkonium chloride to healthy patients, decrease the half-time of the tear film.

### **Clinical observations about corneal toxicity**

The toxic keratitis caused by the detergents have been described in different situations - at the contact lens users or those with dry eye syndrome, either after surgery.

The long-term exposure with products which contain preservatives, may be extremely dangerous, getting to:

- loss of epithelium;
- oedema at stroma's level;
- infiltrations and corneal opacity.

The biomicroscopy exam shows the appearance of epithelial erosions and vascularizations at the inferior level of cornea.

The symptoms are improved when the treatment is stopped, or the contact lenses are getting away or if there are used ophthalmic solutions without preservatives.

Probably that behind a long-term treatment which contains preservatives, these interfere with the cells metabolism, producing toxic effects getting to the death of the cells, premature desquamation of epithelial cells, rupture of stromal keratocytes and possibly degeneration of endothelial cells, and lead to marked ulcerative keratopathies.

Kilt reports the case of a woman aged 46

instilling, for a dry eye syndrome, a solution containing benzalkonium every two hours. She developed a superficial keratitis. The symptoms worsened, a preservative free treatment was substituted, whereupon the keratopathy regressed after one week.

During general anaesthesia, the cornea is especially sensitive to reduced tear production and ocular lubricants are after prescribed.

Maneke reports a severe corneal aggression with conjunctival hyperaemia, photophobia, reduction of visual acuity, in a man aged 47, who had received an ocular lubricant containing 0,5% chlorobutanol, a preservative normally less toxic than benzalkonium chloride. Fluorescein staining showed de-epithelialised areas. Symptoms were alleviated after 3 days treatment with AB, anti-inflammatory drugs and artificial tears, preservative-free. Visual acuity reverted to normal after 2 weeks.

To avoid a possible contamination which will increase the microbial flora, almost all the eyedrops of ophthalmic use contain preservatives, bactericides, bacteriostatics and/or antifungicides, compatible with the other solution components.

The antiseptical property of the preservatives depend on the non-specific biological activity which results on solubility or membranes, an increase of ionic permeability and/or the cells metabolic inhibition. Using these substances in ophthalmic solutions is risky. The use of preserved eyedrops is not free of risks, especially for the conjunctival-corneal surface.

Although the ophthalmic use solutions were preliminarily tested, both clinic and paraclinic, for proving the low degree of toxicity, there were patients which accused of stinging and burning, dry eye syndrome and discomfort.

### **The dry eye syndrome**

In this syndrome, the eyedrops preservative-free are most efficient in keeping the affected corneal epithelium integrity.

Goblet made a comparative study on 56 patients which have got keratoconjunctivitis sicca. The treatment with preservative-free solutions based on carboxymethylcellulose conducted to a sensitive improvement of the functional symptoms of superficial punctate keratitis and squamous metaplasia, in comparison with the patients treated with preservative artificial tears.

These results have been confirmed by Smith in a study on 30 patients with dry eye syndrome, inefficiently treated with solutions having preservatives, were treated with preservatives from eyedrops in one eye, in the other remaining the same drops. After 2 weeks, 63% of patients declared they prefer the preservative free eyedrops, having a considerable improvement of the symptoms. In the eye treated with preservative eyedrops there are no modifications.

## **CONCLUSIONS**

- the eyedrops used in ophthalmology for treatment and diagnosis contain, beside the active substance, one preservative with bactericide and fungicide role, many times responsible of allergic reactions.

- the sensibility for preservatives is growing up because there are inside both ophthalmic used solutions and usual products, like: soaps, cosmetics, dezinfectants.
- although, considering the occurrence of adverse effects (stinging, burning, hyperaemia, ocular pruritus), it is advisable to restrict the use of preserved eyedrops and to replace them with preservative-free alternatives, these being most efficient in keeping the corneal epithelium integrity.

### BIBLIOGRAPHY

1. Prof. Christophe Baudouin, Quinze-Vingts National Hospital Centre for Ophthalmology, Paris, France: 10 years of preservative-free eyedrops.
2. Tripathi, B.J., Tripathi, R.C., and Kolli, S.P. Cytotoxicity of ophthalmic preservatives on human corneal epithelium. *Lens Eye Toxic Res.*
3. Gasset AR. Benzalkonium chloride toxicity to the human cornea. *Am.J. Ophthalmol.* 1987;
4. Garcher C, Bron A, Baudouin C, Bildstein L, Bara J. New method for studying mucus changes in tears. *Ophthalmol.* 1998;
5. Liesegang TJ. Conjunctival changes associated with glaucoma therapy; implications for the external disease consultant and the treatment of glaucoma. *Cornea.* 1998;
6. Liu H, Routley I, Teichmann KD, Toxic endothelial cell destruction from intraocular benzalkonium chloride. *J. Cataract Refract Surg.*
7. Manecke GR Jr, Tannenbaum DP, McCoy BE. Severe bilateral corneal injury attributed to a preservative-containing eye lubricant. *Anesthesiology.* 2000;
8. Wilson WS, Duncan AJ, Jay JL, Effect of benzalkonium chloride on the stability of the precorneal tear film in rabbit and man.
9. Zabel RW, Mintsoulis C, MacDonald IM, Valberg J, Tuft SJ, Corneal toxic changes after cataract extraction. 1989;
10. Robert, P.Y, and Adenis, J.P. Comparative review of topical ophthalmic antibacterial preparations. 2001;
11. Lass, J.H., Mack, R.J., Imperia, P.S., Mallick, and Lazarus, In vitro analysis of aminoglycoside corneal epithelial toxicity. 1989.

# OUR EXPERIENCE WITH THE ALLEGRETTO WAVE LIGHT EYE Q 400 HZ EXCIMER LASER IN PATIENTS WITH HYPEROPIA AND HYPEROPIC ASTIGMATISM

MONICA GAVRIȘ, GENOVEVA OLARU, DIANA POPA, L. LEVAI

LASER OPTISAN & OPTISAN 2002 SRL Ophthalmologic Clinic Cluj-Napoca

**Abstract:** Allegretto Wave Eye Q 400 Hz excimer laser is the most rapid laser system available in the correction of the sight that allows the correction with 1 diopter in 2 seconds. The aim of the study is to evaluate the efficiency and safety of the excimer laser Allegretto Wave Eye Q 400 Hz in the correction of the hypermetropi and hypermetropic astigmatism. A prospective study has been realised on 12 patients, respectively 23 eyes with hypermetropi and hypermetropic astigmatism. The patients's ages are of 20 to 58 years. The functional results have been evaluated in one week, one month, two months and 6 months postsurgery. The surgical correction of the hypermetropi and hypermetropic astigmatism remains a challenge in the refractive surgery. WaveLight Allegretto Eye Q 400 Hz excimer laser represents a solution to the reduction of the dioptries in patients with hypermetropi and hypermetropic astigmatism until 6 dioptries, if the patient's selection is well done and the patient has no great expectations.

**Keywords:** Allegretto Wave Eye Q 400 Hz laser excimer

**Rezumat:** Laserul excimer Allegretto Wave Eye Q 400 Hz este cel mai rapid sistem laser disponibil pentru corectia vederii ce permite corecția de 1 dioptrie în 2 secunde. Scopul studiului este de a evalua eficacitatea și siguranța laserului excimer Allegretto Wave Eye Q 400 Hz în corecția hipermetropiei și astigmatismului hipermetropic. A fost realizat un studiu prospectiv pe 12 pacienți, respectiv 23 ochi cu hipermetropie și astigmatism hipermetropic. Vârstele pacienților au fost cuprinse între 20+58 ani. Rezultatele funcționale au fost evaluate la 1 săptămână, 1 lună, 2 luni și la 6 luni postoperator. Corecția chirurgicală a hipermetropiei și astigmatismului hipermetropic rămâne o provocare în domeniul chirurgiei refractive. Laserul excimer WaveLight Allegretto Eye Q 400 Hz reprezintă o soluție de reducere a dioptriilor la pacienții cu hipermetropie și astigmatism hipermetropic până la 6 D, dacă selecția pacienților este bine făcută și dacă pacientul nu are așteptări exagerate.

**Cuvinte cheie:** laserul excimer Allegretto Wave Eye Q 400 Hz,

## INTRODUCERE

WaveLight was the first to introduce in the USA the high speed Laser for vision correction. **Allegretto**

**Wave Eye Q 400 Hz** excimer laser is the fastest laser available today. It corrects 1 diopter in 2 seconds. The high speed Eye-Tracker follows eye movements, checking the eye's position 400 times every second providing an exact placement of every laser beam on the cornea. The ultra-fine profile of the laser (0.95nm) sculpts the corneal surface with utmost precision.(1)

## SCOPUL LUCRĂRII

To evaluate the efficacy and safety of the **Allegretto Wave Eye Q 400 Hz** excimer laser for the correction of hyperopia and hyperopic astigmatism.

## MATERIAL ȘI METODĂ

Prospective clinical study on 12 patients (23eyes), with hyperopia and hyperopic astigmatism who underwent laser vision correction using Lasik technique and the Wave Light Allegretto Eye Q 400Hz excimer laser.

Patients had ages ranging between 20 and 58 years.

Every patient underwent a meticulous preoperative protocol consisting of:

- Best corrected visual acuity (BCVA)
- Cycloplegic refraction
- Anterior and posterior segment exam
- IOP
- Keratometry
- Pachymetry
- Corneal topography

Results were evaluated 1 week, 1, 2, 6 months postoperatively.

Preoperative BCVA ranged between 0.4 and 5/5.

Following cycloplegia, hyperopia ranged between 2.75 and 7.50 D and astigmatism ranged between 0 and 6 D, 11 eyes presenting hyperopia and 12 hyperopic astigmatism.

Anterior and posterior segments were normal, 1 patient presenting convergent squint.

Keratometry, Pachymetry, Corneal topography were executed using the Oculyzer corneal topographer. Based on Pentacam technology that uses Scheimpflug three-dimensional imaging, the Oculyzer provides:

- Corneal topography
- Keratoconus detection and grading

- Complete 3D anterior chamber analysis
- Lens analysis
- Oculink software for customized laser correction (2)  
Corneal topography excluded keratoconus, all cases of astigmatism being with the rule.  
Keratometry readings ranged between 40 and 46 D.  
Pachymetry ranged between 507 and 640  $\mu\text{m}$ .  
Surgical technique – LASIK
- 130  $\mu\text{m}$  flap made with Rondo microkeratome and 8.5mm suction ring
- 6.5 mm optical zone
- BSS rinsing of the ablation surface
- Flap adjustment + TCL
- Postoperative treatment with antibiotic + dexamethazone and artificial tears.

### RESULTS

UCVA was better than 0.5 in 9 patients and lower than 0.5 in 1 patient. 2 patients had BCVA over 0.5. 9 out of 12 patients gained estimated diopter reduction, the remaining presented 1.5-2 D of residue. Patients with 1.5-2 D of residue presented more than 6 D preoperatively.

The patient with convergent squint, presented orthoposition postoperatively.

None of the patients lost any line on Snellen chart, one patient with hyperopic astigmatism gained 3 lines.

All patients were satisfied.

Intraoperative complications did not exist. The flap was clean, with smooth edges, well positioned, without interface debris after 2 and 7 days postoperatively.

Postoperative complications occurred in 2 cases:

- In 1 case, margin sclerosis of the flap occurred, one month postoperatively, which resolved under anti-inflammatory treatment.
- In 1 case, epithelial ingrowth appeared 0.5 mm under the temporal margin one month postoperatively. The affected area was rinsed and under topical cortisone the evolution was favorable.

### DISCUSSION

A study conducted on 120 patients with hyperopia and hyperopic astigmatism, followed 12 months postoperatively, revealed a stable refraction of  $\pm 0.50$  D variation from the target refraction in 92 % and 71% of patient respectively, according to the degree of refractive error.(3)

Another study conducted in Spain on hyperopic patients up to 6.25D revealed that 70% of patients with hyperopia under 3 D and 63 % over 3 D had a  $\pm 0.50$  D postoperative refraction. Approximately 20% of patients needed a second intervention.(4)

In our study postoperative refraction was stable 1, 2 months postoperatively. Four patients had stable refraction 6 months postoperatively.

VA was good in all the patients, no one complaining of haze or night vision difficulties.

### CONCLUSION

1. Correction of hyperopia and hyperopic astigmatism remains a challenge in the treatment of refractive surgery.
2. The possibility of regression remains a problem in this field because of the filling of the ablated area due to natural or hyperplastic healing of the cornea.
3. WaveLight Allegretto Eye Q 400 Hz excimer laser is a trustworthy tool in diopter reduction in patients with hyperopia and hyperopic astigmatism up to 6 D, if the patient is well selected and doesn't have exaggerated expectations.

### BIBLIOGRAFIE

1. [http://www.eagleeyecentre.com.sg/allegretto\\_wave.html](http://www.eagleeyecentre.com.sg/allegretto_wave.html)
2. <http://www.wavelight.com>
3. A. John Kanellopoulos, MD; Joseph Conway, MD; Lawrence H. Pe, MD and Ian F. Comaish, MA, BM, BCh, FRCOphth. Original Articles: LASIK for Hyperopia With the WaveLight Excimer Laser. Journal of Refractive Surgery Vol. 22 No. 1 January 2006
4. Arun C Gulani, MD. Hyperopia, Lasik. emedicine Nov 24, 2008
5. LASIK safe and effective for treating hyperopia, study says. [www.lasiksurgerynews.com](http://www.lasiksurgerynews.com), JUL 20, 2009

# IS MONOVISION A SOLUTION IN CORRECTING PRESBYOPIA?

ADRIANA STANILĂ

"Lucian Blaga" University Sibiu, Ocular surface research center

**Abstract:** Presbyopia is a physiological condition which affects every person either emetrop, myop, hyperop or astigmat. The optical correction of presbyopia may be done using: glasses (mono, bi, tri, multifocal lens); bifocal or multifocal contact lens. The optic correction can be done monocular or binocular. Can monovision be a solution for correction of the presbiopia?

**Keywords:** presbyopia, contact lenses, monovision

**Rezumat:** Prezbiopia este o tulburare fiziologică a acomodatiei ce apare la toți indivizii, fie ei emetropi, hipermetropi, miopi sau astigmati. Corecția prezbiopiei se poate face optic cu: lentile aeriene (mono, bi, tri sau multifocale); lentile de contact bifocale sau multifocale. Corecția optică se poate face monocular sau binocular. Este oare monovision o soluție în corecția prezbiopiei?

**Cuvinte cheie:** prezbiopia, lentile de contact, monovision

## INTRODUCERE

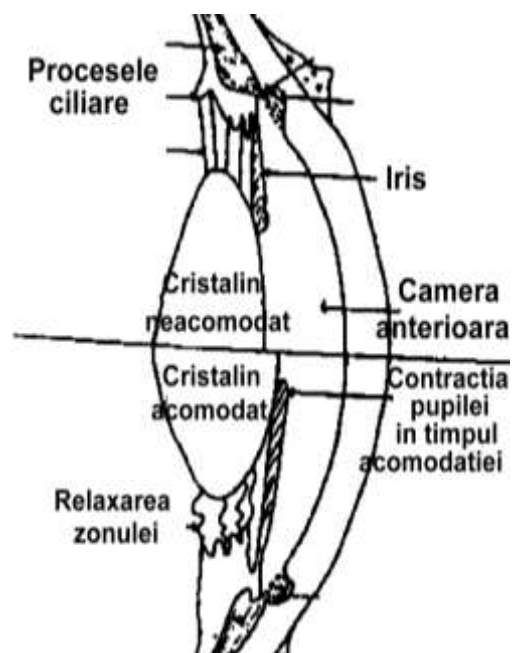
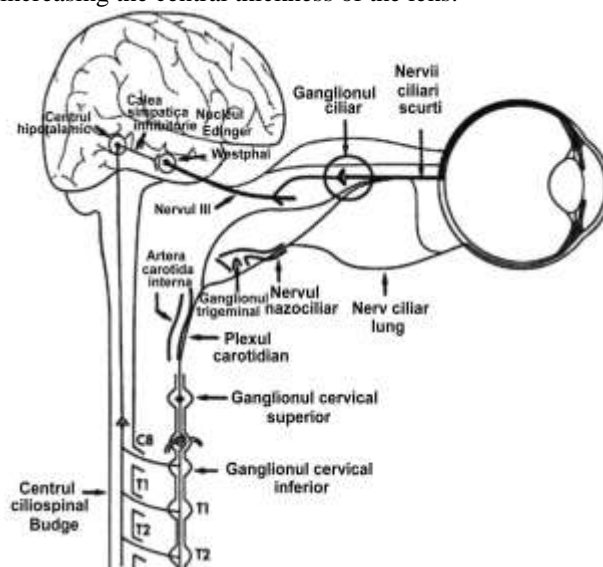
Presbyopia has been described by Michaels D. as "an irreversible optical failure, an unexplained evolutionary blunder that comes as a psychological shock."

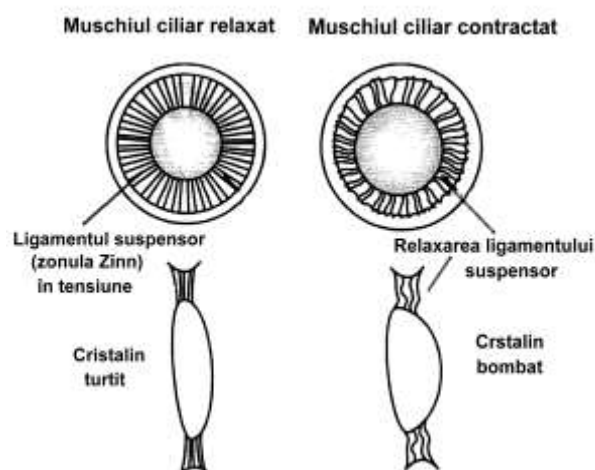
Presbyopia (Greek word "presbys" - πρέσβυς), meaning "old man" or "elder", with Latin root "-opia", meaning "eye") describes the condition where the eye exhibits a progressively diminished ability to focus on near objects with age. Presbyopia is one of the earliest signs of aging. Age is the major risk factor for presbyopia and primitive cataract - the most common diseases of the lens.

Presbyopia's specific mechanisms are not known for sure, however, the research evidence most strongly supports a loss of elasticity of the crystalline lens, although changes in the lens's curvature from continual growth and loss of power of the ciliary muscles (the muscles that bend and straighten the lens) have also been postulated as its cause. Although there are still structurally and functionally uncertainties about the ciliary muscle, it is certain that this is the engine of the accommodation mechanism.

Currently presbyopia is explained by the hypothesis of Helmholtz which says that for distance vision the ciliary muscle relaxes and the zonula becomes tensioned. When the eye accommodates the ciliary muscle contracts, decreasing the tension of the zonula. Lowering

the zonular tension in the presence of an elastic lens capsule is followed by lowering of the equatorial diameter and of the radius of the lens both sides curvature and increasing the central thickness of the lens.





Presbyopia can be corrected with glasses or contact lenses. In some cases, the addition of bifocals to an existing lens prescription is enough. As the ability to focus up close worsens, the prescription needs to be changed. With the use of contact lenses, some people choose to correct one eye for near and one eye for far vision. This is called "monovision" and eliminates the need for bifocals or reading glasses, but it can affect depth perception.

There are also newer contact lenses that can correct for both near and far vision with the same lens – multifocal contact lenses. New surgical procedures can also provide solutions for those who do not want to wear glasses or contacts.

Spectacle correction of presbyopia

- Separate reading spectacles: normal or 'half eye' frames
- Bifocal/trifocal lenses: two or three zones of correction (distance / near or distance / near / intermediate)
- Progressive / Varifocal: Gradual change in power from distance to near (all zones in focus)

Contact lens options

- Simultaneous vision: concentric bifocal c.l., aspheric (progressive) c.l.
- Alternating vision: translating design
- Monovision

Surgical treatments of presbyopia

- Surgical reversal of presbyopia – scleral expansion bands (SEB) placed below the surface of the eye's sclera
- Anterior ciliary sclerotomy – 8 incisions in a radial pattern across the surface of the sclera
- Laser presbyopia reversal – similar to anterior ciliary sclerotomy
- Photophaco reduction – uses a laser to create cavities in the lens and reduce its size
- Lens replacement

Monovision represents the art of science of fitting contact lenses on a patient with presbyopia: one eye is fit with a distance lens (if needed) and the other eye is fit with a near lens. When we look into the distance we

are using the vision from the dominant eye. Our brain pays more attention to the visual information received from the dominant eye.

Monovision works because the brain is tricked into thinking that the CL actually is a part of the natural eye. Monovision is a blend of near and distance vision, ideal for people with an active lifestyle.

Usually request a brief period of adaptation as the brain "learns" to see with the eye best suited for the task. The process of adaptation to monovision usually takes about 1 – 2 weeks when the brain begins to use the eyes in monovision manner and the person becomes unaware which eye is focused at near and which at distance. Reading glasses may occasionally still be required for some near activities.

The most common method of achieving monovision is through the use of CLs. With glasses, the difference in the thickness of the glass between the two eyes can cause bothersome symptoms. Monovision can also be obtained by surgical means: excimer laser refractive surgery – LASIK or PRK. Last but not least monovision can be a result of cataract surgery, using IOL in one eye for near and a distance focused lens in the other.

10 -15% of people who try monovision do not adapt because of eyestrain or headaches or mild loss of stereo vision. Usually is better to prescribe monovision with enough correction to allow good intermediate distance viewing, for example for reading larger prints like a dinner menu. For very fine print or small objects, monovision patients may still need the help of reading glasses.

Correcting presbyopia with contact lenses can be both rewarding and challenging. While somewhat dependent on the lens type chosen and patient-related factors, the degree of difficulty encountered when correcting presbyopia with contact lenses can sometimes approach that of other, technically more demanding, tasks such as astigmatism and keratoconus. The nature and significance of presbyopia itself may need to be explained clearly to the patient before proceeding to detail their correction options (i.e. contact lenses and spectacles) along with the advantages and disadvantages of each. The correction of presbyopia is more about selecting a lens type/correction mode that will provide acceptable vision at both distance and near, often being something of a compromise at one distance at least. Monovision provides the simplest method of correcting both distance and near vision with contact lenses. A more complex monovision approach uses a bifocal lens in one eye and a single vision contact lens in the other, i.e. so-called modified monovision. Usually, the single vision lens is used to correct the patient's vision for their most critical viewing distance, i.e. distance or near. Correction of young presbyops is better tolerated with multifocal contact lenses in both eyes (simultaneous vision). Success rate depends on: previous correction, occupation, motivation. Presbyops over 50 years old – in our opinion – are the best candidates for monovision correction – correcting the

dominant eye for distance and the non dominant eye with a multifocal lens.

### **BIBLIOGRAFIE**

1. Michaels DD., Visual optics and refraction: a clinical approach, 3rd ed. St. Louis
2. Stanila Adriana, ABC in oftalmologie, Ed. Tribuna Sibiu, 1997
3. Stanila Adriana, Cristalinul, Ed. Polsib Sibiu, 2001
4. Judith Lee, Gretchyn Bailey, Presbyopia
5. Khiun F. Tija, Cataract & Refracting Surgery: Monovision: A Multitude of Options and Opinions, October 2009, Volume 4, No.9
6. American Optometric Association, Monovision, 3 Nov 2007
7. Sherman Winston Reeves, Monovision
8. Robert Abel, The Eye Care Revolution: Prevent and Reverse Common Vision Problems, Kensington Books, 2004
9. Garcia Serrano, JL; Lopez Raya; Mylonopoulos Caripidis, Variables related to the first presbyopia correction, Archivos de la Sociedad Espaniola de Oftalmologia
10. Eg, Free Eye Exercises for better vision Malecaze, FJ; Gazagne; Tarroux; Gorrard, Scleral expansion bands for presbyopia

## THE USE OF HUMAN AMNIOTIC MEMBRANE IN OCULAR SURFACE DISEASES

ADRIANA STĂNILA<sup>1</sup>, DIANA MIHU<sup>2</sup>, T. PRIPOREANU<sup>3</sup>, ANDREEA BOTEZAN<sup>4</sup>,  
I. COSTACHE<sup>5</sup>, D. STĂNILĂ<sup>6</sup>

<sup>1,3,6</sup> "Lucian Blaga" University of Sibiu, <sup>2,4</sup> Emergency Hospital Sibiu, <sup>5</sup> Ocular Surface Research Center Sibiu

**Abstract:** This study presents various methods of possible use of the human amniotic membrane in the pathology of the eye surface. The study lot consists of 39 cases, with different pathologies, that required human amniotic membrane (HAM) transplant. The results indicate that HAM significantly decreases the ocular symptoms, is an inexpensive and reiterative solution and has a very good tectonic effect in the corneal perforations, utilised correctly is an inovative solution in the treatment of the ocular surface diseases.

**Keywords:** amniotic membrane, pterygium, bullous keratopathy, corneo-conjunctival burns, exposure keratopathy, corneal ulcer

**Rezumat:** Lucrarea prezintă diferite modalități de folosire a membranei amniotice umane în patologia suprafeței oculare. Lotul de studiu este format din 39 cazuri, cu diferite patologii, care au necesitat transplant de membrană amniotică umană (MAU). Rezultatele studiului indică faptul că MAU reduce semnificativ simptomele oculare, este o soluție ieftină și repetitivă, are un efect tectonic bun în perforațiile corneene, utilizată corect este o soluție inovatoare pentru tratamentul afecțiunilor suprafeței oculare

**Cuvinte cheie:** membrană amniotică umană, pterigion, keratopatie edemato-buloasă, arsuri corneo-conjunctivale, keratopatie de expunere, ulcer cornean.

### INTRODUCTION

The amniotic membrane has a total thickness of 0.5 mm and is composed of three layers; one layer of cubic epithelial cells, basement membrane with a thickness of about 200 – 300 nm and an avascular stroma made out of a collagen network with few fibroblasts.

The properties of human amniotic membrane (HAM) that made it fit to be used are:

- it stimulates reepithelization by modulating the epidermic growth factor, keratocyte growth factor, fibroblast growth factor and  $\alpha$  and  $\beta$  growth factor.
- antiinflammatory effect by modulating some proinflammatory cytokines (TGF $\alpha$ , TGF  $\beta$ , IL 1 $\alpha$  and 1 $\beta$ , keratocyte growth factor etc.)
- antibacterial properties
- immunomodulating effect (incomplete expression of HLA-A, B, DR antigens), which makes the use of immunosuppressors unnecessary.

- inhibits vascular endothelium growth and thus prevents neovascularization
- inhibits scar formation by suppressing miofibroblast differentiation to fibroblasts and the production of extracellular matrix.

The indications of HAM in the ocular surface pathology are:

- Persistent corneal epithelial defects
- Conjunctival defects
- Surgical correction of simblefaron
- Burns
- Pterygium recurrence in combination with limbic cells transplant.
- Ex-vivo expansion of limbic stem cells

The techniques for using the HAM are:

1. PATCH (OVERLAY): the HAM is sutured at the episclera, circular above the epithelial or stromal defect, while the margins of the defect remain under the HAM.
2. GRAFT (INLAY – one or more layers): the HAM is sutured at the ulceration site and the corneal epithelium regenerates above it. HAM functions as a basement membrane, is integrated in the cornea and remains there for a few months. It is important for the epithelium to be removed around the ulceration and for the HAM to be sutured in the opaque stroma. If the ulceration is deep, the HAM may be applied in more layers, and we can suture only the one on top.
3. SANDWICH: combines the previous two techniques. This technique has a high success rate and a low recurrence incidence.

### AIM OF STUDY

We want to show different modalities of using the human amniotic membrane in several ocular surface diseases.

### MATERIAL AND METHOD

In 2003-2009 we used the HAM transplant in 39 cases with different pathologies:

- Bullous keratopathy, 12 cases
- Pterygium, 10 cases
- Corneo-conjunctival burns, 4 cases
- Exposure keratopathy, 4 cases
- Neurotrophic keratopathy, 2 cases



- Perforated corneal ulcer, 3 cases
- Herpetic keratitis, 2 cases

The surgery is made in topical and/ or retrobulbar anesthesia. The HAM is placed with the epithelial part on top and is sutured with separate suture points if the suture is cornean, or continuous suture if it is limbic. After surgery we apply a therapeutic contact lens to fixate the membrane and to delay its resorbtion. The suture points are removed after at least one month in order to prevent angiogenesis.

### RESULTS

The patients with bulous keratopathy following cataract surgery by facoemulsification present with symptom like ocular pain, foreign body sensation, photophobia, tearing. After doin the HAM transpalnt these symptoms are reduced gradually.

Figure no. 1. Fist day postop



Figure no. 2. 1 month postop



Figure no. 3. 6 months postop



In large pterygiums and aggressive recurrences we thought necessary the HAM transplant together with a therapeutical contact lens after surgical excision of the pterygium.

Figure no. 4. Pterygium preop



Figure no. 5. 7th day postop (HAM+TCL)



Figure no. 6. 6 weeks postop



We used the HAM transplant in old corneo-conjunctival burns with simblefaron formation with good results.

Figure no. 7. Old corneo-conjunctival burn



Figure no. 8 HAM transplant

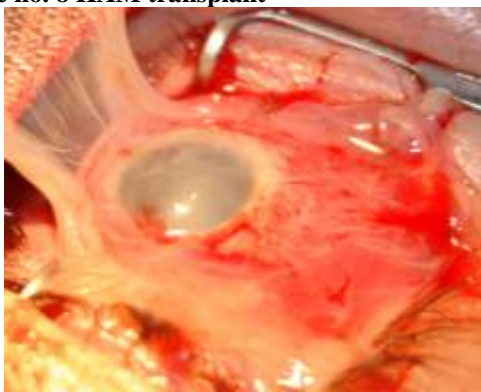


Figure no. 9. 14<sup>th</sup> day postop



### CONCLUSIONS

- In bullous keratopathies the amniotic membrane transplant reduces the symptoms (pain, foreign body sensation, photophobia, tearing).
- Although the transplant of the amniotic membrane can not be considered the final solution in bullous keratopathy, it has great benefits being a cheap and repetitive option for these patients, before doing the perforating keratoplasty.
- Using amniotic membrane transplant combined with TCL in the treatment of large pterygia or aggressive recurrences is a promising option in the management of this unpleasant corneal disease.
- Amniotic membrane transplant associated with TCL provides good tectonic effects in corneal perforations.

Fresh HAM correctly used and fixed is an innovating solution for treating ocular surface diseases.

### BIBLIOGRAFIE

1. Ozkurt YB, Kocams O, Comez A, Uslu B, Dokan OK (2009). Treatment of Primary Pterygium. *Optometry and Vision Science*.
2. Jain, A MD; Bansal, R MD; Sukhija, J MD (2008). Human Amniotic Membrane Transplantation With Fibrin Glue in Management of Primary Pterygia: A New Tuck-in Technique. *Cornea*, 27, 94-99.
3. Muller M, Meltendorf C, Mirshashi A, Kohnen T(2009). Use of multilayer amniotic membrane as first therapy for penetrating corneal ulcers. *Klinische Monatsblätter für Augenheilkunde*, 8, 640-4.

4. Resch M, Resch B, Imre L, Nemeth J, Csanyi E (2009). Permeability of human amniotic membrane to ofloxacin in vitro. *Investigative ophthalmology*.
5. Resch M, Schlotzer U, Hofmann C, Sauer R, Kruse F, Beckmann M, Seitz (2009). Integration patterns of cryopreserved amniotic membranes into the human cornea. *Ophthalmology*, 11, 1927-35.
6. Miranda-Rollon, Sentieri A, Martinez R, Junceda-Moreno C (2009). Treatment with amniotic membrane in keratolysis secondary to adult gonococcal keratoconjunctivitis. *Archivos de la Sociedad Espanola de Oftalmologia*, 3,155-7.
7. Kheirkhah A, Johnson DA, Paranjpe DR, Raju V, Casaa V, Tseng SC (2009). Temporary sutureless amniotic membrane patch for acute alkaline burns. *Archives of ophthalmology*, 8, 1059-66.
8. Barequet IS, Habet-Wilner Z, Keller N, Smollan G, Ziv H, Belkin M, Rosner M (2008). Effect of amniotic membrane transplantation on the healing of bacterial keratitis. *Investigative Ophthalmology & visual science*, 49(1), 163-7.
9. Dekaris I, Gabrić N, (2009). Preparation and preservation of amniotic membrane. *Developments in Ophthalmology*, 43, 97-104.
10. Kitagawa K, Yanagisawa S, Watanabe K, Yunoki T, Hayashi A, Okabe M, Nikaido T (2009). A hyperdry amniotic membrane patch using a tissue adhesive for corneal perforations and bleb leaks. *American Journal of Ophthalmology*, 148(3),383-9.
11. Ozer A, Yildirim N, Erol N, Yurdakul S (2009). Long-term results of bare sclera, limbal-conjunctival autograft and amniotic membrane graft techniques in primary pterygium excisions. *Ophthalmologica*, 223(4), 269-73.
12. Yoon KC, Im SK, Kim JC, Yoon KW, Choi SK (2009). Prognosis of paraquat-induced ocular surface injury: therapeutic effect of amniotic membrane transplantation. *Cornea*, 28(5), 520-3.

# OSMOPROTECTION - A NEW APPROACH TO TREATING DRY EYE

GABRIELA OPREA

Bucuresti

**Abstract:** Dry eye disease is characterized by a compromised tear film (cracked, desiccated appearance) and cells that are dehydrated and out of balance. Many artificial tears products provide only a single mode of protection against dry eye and simply supplement a compromised tear film. Osmoprotection is a new approach to treating dry eye by providing cellular protection against the effects of hypertonicity.

**Keywords:** osmoprotection, lacrimal film, artificial tears

**Rezumat:** Patologia ochiului uscat este caracterizată printr-un film lacrimal compromis, întrerupt și cu celulele epiteliale deshidratate și în dezechilibru. Majoritatea produselor de tip lacrimi artificiale oferă doar un singur mod de protecție împotriva uscării ochiului și acesta este simpla suplimentare a filmului lacrimal compromis. Osmoprotecția este o nouă abordare în tratamentul ochiului uscat, o abordare ce asigură protecția celulelor epiteliale corneene împotriva efectelor hipertonicității.

**Cuvinte cheie:** osmoprotecție, film lacrimal, lacrimi artificiale

and quality of the tear film. This results in an unbalanced tear film that can no longer provide sufficient nourishment or protection to the ocular surface. In turn, this may lead to permanent damage to the corneal epithelium cells as well as to the corneal nerve fibers that trigger tear secretion.

In summary, the tear film in dry eye is thinner and more unstable than healthy tear film, and the balance of electrolytes, proteins, and mucins has been upset.

Symptoms vary from patient to patient, but most commonly they include itching; a sandy, gritty feeling; burning; sensitivity to bright lightning and sunshine; foreign-body sensation; irritation; pain; blurred vision; and contact lens intolerance. In extreme cases, dry eye disease can also lead to permanent visual impairment.

Most artificial tears contain similar ingredients: lubricants, water, electrolytes, buffers, and a preservative. However, they differ in: the type of lubricant (carboxymethylcellulose (CMC), polyvinyl alcohol, polyethylene glycol, etc), chemical properties (unique buffers, osmotic agents, etc), type of preservative, viscosity.

Although all currently available artificial tear solutions simply moisturize the eye, the different artificial tears utilize different approaches to achieve this goal. These mechanisms include tears that:

- Counteract hypertonicity: hypotonic solutions may be used to provide temporary relief by increasing water content
- Contain oil: improve lipid layer of tear film to prevent tear evaporation
- Increase retention time: work by increasing viscosity or use ingredients with bioadhesive properties to increase the retention of tears on the ocular surface

Compatible solutes: small, non-ionic organic compounds that build osmotic strength intracellularly without damaging proteins

When tear film is healthy, it maintains a constant osmolarity of about 295 to 305 mOsm/L. In dry eye, however, the quantity of water in the tear film is decreased, perhaps as the result of high evaporation or because sufficient water is not produced in the first place. Because there is less water in the tear film, the concentration of solutes such as sodium and potassium increases. This raises the osmolarity and upsets the

## INTRODUCERE

Put simply, in a healthy ocular surface, the tear film is uncompromised, the epithelial cells are hydrated and in osmotic balance, and the tear film provides maximum comfort.

Since there is no blood supply to the ocular surface, natural healthy tears are essential for maintaining optimal ocular health. Besides providing a proper chemical environment at the ocular surface, the tear film also serves a number of important functions in maintaining the overall health of the eye, including: ocular surface comfort, protection from infection, nutrition, wound healing, and cell growth, optical clarity and refractive power.

In order to perform these critical functions, normal healthy tears contain a complex and balanced mixture of electrolytes, proteins, and mucins. These key elements are found in the 2 components that make up the tear film: the lipid layer and the aqueous/mucin gel.

Dry eye disease is characterized by a compromised tear film (cracked, desiccated appearance) and cells that are dehydrated and out of balance.

In dry eye, underlying changes to ocular health and environment can adversely affect both the quantity

isotonic balance that had existed between the tear film and the ocular epithelial cells. When cells are dehydrated and out of balance, the tear film becomes hypertonic.

The aqueous solution in the tear film is hypertonic in comparison with the aqueous solution within the ocular epithelial cells. In order to restore the isotonic balance, water flows by osmosis out of the ocular epithelial cells. When this happens, the osmolarity of the corneal epithelial cells rises beyond accepted levels and they can cease to function properly.

Many artificial tears products provide only a single mode of protection against dry eye and simply supplement a compromised tear film. Their primary mechanism of action neutralizes the hypertonic state of the tear film by flooding the ocular surface with moisture. In other words, these agents treat only the tear film component of dry eye conditions. This modality provides only temporary, short-acting symptom relief.

A hypertonic tear film causes cells to desiccate, or lose cell water and volume.

Regulatory volume increase occurs as cells take up salt from the environment to try to return to a normal volume. This results in an electrolyte imbalance. The electrolyte imbalance, if not addressed by compatible solutes, results in cell damage. If the electrolyte imbalance is addressed, by accumulation of compatible solutes, the result is osmoprotection.

L-carnithine and erythritol were identified, separated or in combination, as being protective against cellular stress activation at the level of epithelial corneal cells in hypertonic environment.

Osmoprotection is a new approach to treating dry eye by providing cellular protection against the effects of hypertonicity.

An advanced tear consists of a balanced tear film and healthy corneal epithelial cells.

A dual-action approach provides: hydration and lubrication to the epithelial surface, a protective action against the damaging effects of dry eye on and below the corneal surface.

### **BIBLIOGRAFIE**

1. "Effects of Osmoprotectants on Hyperosmolar Stress in Cultured Human Corneal Epithelial Cells" Rosa M. Corrales, MD, Lihui Luo, MD, Eliseu Y. Chang, MD, and Stephen C. Pflugfelder, MD

## A NEW APPROACH OF THE DRY EYE SYNDROME; THE TEAR FILM STABILIZATION

ADRIANA STANILĂ

“Lucian Blaga” University Sibiu, Ocular surface research center

**Abstract:** *The dry eye syndrome is a multifactorial condition of the tears and the ocular surface that causes symptoms of ocular distress, affecting the sight, the lack of balance of the lacrimal film with a destructive potential on the eye surface. The clinical experience lead us to the conclusion that there is a good correlation between the severity of the dry eye syndrome and the presence and intensity of the parallel conjunctival fold with the eyelid. Assuring the lubrication of the cornean surface represents the desideratum in the treatment of the dry eye and is an important factor that we should take into account when we choose the treatment.*

**Keywords:** *dry eye syndrome, lacrimal film, artificial tears*

**Rezumat:** *Ochiul uscat este o afecțiune multi – factorială a lacrimilor și suprafeței oculare ce determină simptome de disconfort ocular, afectarea vederii și instabilitatea filmului lacrimal, cu potențial distructiv asupra suprafeței oculare. Experiența clinică a dus la concluzia că există o bună corelare între severitatea sindromului de ochi uscat și prezența sau intensitatea pliurilor conjunctivale paralele cu pleoapa. Asigurarea lubrifierii suprafeței corneene reprezintă un deziderat al tratamentului ochiului uscat și ca urmare, este un factor important de care trebuie să ținem cont în alegerea tratamentului.*

**Cuvinte cheie:** *ochi uscat, film lacrimal, lacrimi artificiale*

Tear film instability can be determined either by a chronic / recurrent inflammation (allergy, blepharitis, rosacea, environment, preservative, contact lenses and contact lenses solutions, chalasis / lid margin irregularities), either by acute aggressions (viral / bacterial conjunctivitis, preservative, cataract / refractive surgery / Lasik). Hypo secretion is determined by Sjögren's Syndrome or other autoimmune diseases, menopause, neurotrophic diseases or different systemic drugs (antidepressants, beta-blockers, antihistamines)

It can be assumed that the clinical picture of the dry eye will be diagnosed even more frequently in future. The diagnosis of the dry eye disease is based on subjective symptoms, objective clinical signs and diagnostic tests. There are several various clinical diagnostic tests in use; however the correlations between their results are weak (1,2,3,4,5).

Clinical experience gave rise to the assumption that there is a relation between the degree of severity of the dry eye syndrome and the presence or the intensity of the lid-parallel conjunctival folds (LIPCOF). This relation was examined by Höh, Schirra, Kienecker and Ruprecht and classified in the form of a grading scheme.

Lid-parallel conjunctival folds (LIPCOF) is a non-invasive, simple diagnostic test for dry eye diseases (6,7,8,9). During slit lamp examination it can be observed the presence and degree of lid-parallel conjunctival folds bordering the posterior lid margin as described by Höh et al. (10,11).

Höh et al. (11) showed LIPCOF as a diagnostic tool facilitates diagnosis of dry eye syndromes. Based on their results it seems that LIPCOF is a sure sign of dry eye: in 267 patients they found 75.95 % negative predictive value and 93.09 % positive predictive value (11). For comparison, a much used test in dry eye diagnosis – TFBUT (tear film break-up time), has a 72,2% positive predictive value (16). However, few authors found only minor differences in LIPCOF signs between moderate dry eye subjects and healthy persons (12,13).

Höh et al also proposed that LIPCOF can be reversed by intensive dry eye treatment (14). Dausch et al (15) found that dry eye therapy improved significantly the LIPCOF parameter and it can be useful in monitoring dry eye treatments

### INTRODUCERE

Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability, with potential damage of the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface (16).

The incidence of dry eye syndrome is on the increase. Known risk factors, such as computer monitor work, taking of certain pharmaceutical drugs, air-conditioning systems and central heating indicate that it is a typical civilization disease. The prevalence of dry eye also increases with increasing age. The prevalence of dry eye symptoms is reported to be 5-30 percent in adults (2,3).

Etiological classification of the dry eye disease is related to the tear film instability and hypo secretion.

Method of LIPCOF measurement and grading  
LIPCOF can be found nasally, centrally and temporally on both the upper and the lower eyelid. They border on the posterior lid edge running parallel to it. Most frequently, the LIPCOF appear inferiorly temporal. For this reason, this quadrant of the palpebral fold is examined with the slit lamp. The examination is performed on the non-manipulated eye in primary position.

The eye of the patient is in primary position (patient looks straight ahead). The patient should have some blinks. Then you can evaluate the LIPCOF stage as Höh et al have described them at the lower lid margin in the temporal lower quadrant without touching the eyelids. The examiner looks for a horizontal conjunctival fold at the transition from the middle to the temporal one-third of the lower lid (10,11,14,15), with the slit lamp adjusted to general observation magnification (10,11,14,15). The degrees are according to the size of the conjunctival folds as compared to the height of the normal tear meniscus height and to the number of individual folds they comprise. The lower limit value for the height of the normal tear meniscus amounts to 0.2 mm.

Real LIPCOF's disappear, when you pull the lower eye lid away from the eye. They form again after some blinks and they always form in the same stage.

With Degree 0, no conjunctival fold exists. This applies to the state of rest of the eye and does not exclude that a conjunctival fold is pushed ahead of the lower eyelid when the eye is being closed. No dry eye.

LIPCOF Degree 1 describes the permanent presence of an individual fold, which does not exceed the height of the normal tear meniscus. Mild intensity of dry eye.

With Degree 2, because of a higher volume, the LIPCOF disintegrates into two or several small parallel folds, which however are lower than the normal tear meniscus. Moderate intensity of dry eye.

If there are several, parallel conjunctival folds exceeding the height of the normal tear meniscus, LIPCOF Degree 3 exists. Severe intensity of dry eye.

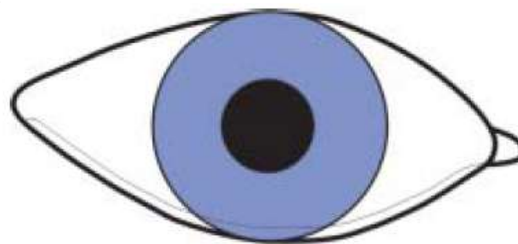
**Table no. 1. Summarizes the LIPCOF Degrees and their interpretation.**

Degree of intensity of LIPCOF	Description of the finding of the conjunctival fold in primary position	Interpretation /intensity of the dry eye syndrome
Degree 0	No permanently present fold	No dry eye
Degree 1	Single, small fold, smaller than the normal tear meniscus	Mild intensity of dry eye
Degree 2	Fold of up to the height of the normal tear meniscus, multiple folds	Moderate intensity of dry eye
Degree 3	Fold being higher than the normal tear meniscus, multiple folds	Severe intensity of dry eye

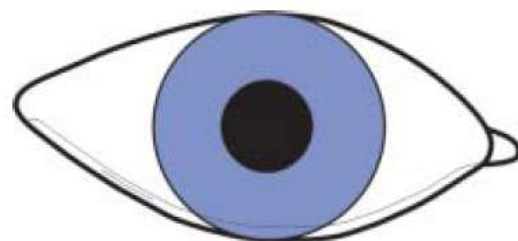
It becomes much clearer that an essential part of the dry eye syndrome management is the stabilization of the tear film. This represents a major action in order to increase TFBU, corneal surface lubricity and the retention time of the lubricant ophthalmic drops on the

corneal surface.

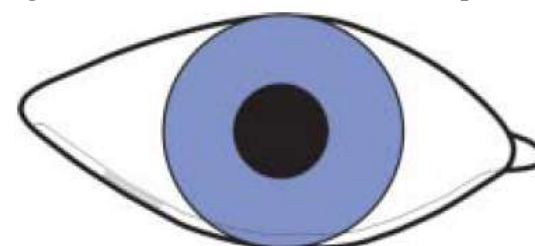
**Figure no. 1. LIPCOF Degree 0 No permanently present fold**



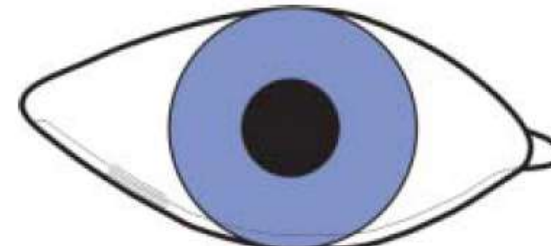
**Figure no. 2. LIPCOF Degree 1 Single, small fold; smaller than the normal tear meniscus**



**Figure no. 3. LIPCOF Degree 2 Fold of up to the height of the normal tear meniscus, multiple folds**



**Figure no. 4. LIPCOF Degree 3 Fold being higher than the normal tear meniscus, multiple folds**



The upper lid exerts significant pressure of 50 – 70 g (18) on the ocular surface and this force is normally mitigated by the lubricity of the tear film. The average pressure during blinking is 10,3 mmHg (19). In a normal eye the lid exerts a smooth even pressure which sweeps the eye, cleaning, surfacing and facilitating the normal removal of dying corneal epithelial cells. In patients with symptomatic ocular dryness, the upper lid exerts a destructive force due to the increase in the coefficient of friction. This results in an exposed ocular surface. Lubrication between lid and ocular surface is an often overlooked cause of discomfort and surface damage; when lubricity decreases, the friction forces increase, and this is the moment when we detect the LIPCOF signs. This should be treated by tear substitute with low

coefficient of friction.

Many factors determine composition and lubricity of the human tear film and its three layers (aqueous, mucin, and lipid). Tear film needs to maintain high lubricity across the ocular surface so that the lid wiper can move across it smoothly. If friction is allowed to build, the constant motion of the lid across the ocular surface can cause discomfort.

But exactly how does a lower coefficient of friction protect the lid and ocular surface? A laboratory study assessed the intrinsic lubricity of SYSTANE® by comparing the coefficient of friction (or the resistance to movement) of earlier generation lubricating eye drops (17). Tissue on tissue cultures representing the eyelid were attached to hemispherical supports and friction was assessed by measuring the speed and force at which the resistance occurred. The results show that SYSTANE® has over 6x greater lubricity than carbomethylcellulose; nearly 4X greater lubricity than polysorbate 80 + glycerin and over 2.5x greater lubricity than HPMC 0.03%. In a clinical context, SYSTANE® uniquely restores lubricity resulting in a decreased coefficient of friction between the upper lid and the cornea. This is one of the key attributes of SYSTANE® and explains its clinical efficacy in reducing dry eye symptoms.

When in bottle, SYSTANE® looks like a normal liquid eye drop. Applied to the corneal surface of a dry eye patient, SYSTANE® forms a protective shield and turns into a gel (in-eye gelling effect) with an action similar to the one of the natural glicocalix. This protective gel decreases evaporation; increases tear film stability, lubricate and help in the initiation of the tissue repairing processes. The increasing intensity of dry eye is directly correlated to the increased pH of the ocular surface, and SYSTANE® viscosity is directly correlated to the ocular pH. So, as higher is the severity of the dry eye, as higher is the gellifying action of SYSTANE®.

In conclusion, ensuring a correct lubrication of the corneal surface represents the main goal of the dry eye treatment and represents an important factor that has to be taken into consideration when choosing the treatment. SYSTANE® ensures the best lubricity compared to the rest of the available artificial tears.

#### **BIBLIOGRAFIE**

1. Begley CG et al. IOVS 2003; 44: 4753-61
2. Brewitt H. , Sistani F.: Dry eye disease: the scale of the problem *Surv. of Ophthalm.* 2001 March;45 (2):199-202
3. Korb D.R., Craig J., Doughty M., Guillon J., Smith G.: The tear film. Structure, function and clinical examination. Butterworth-Heinemann,2002
4. Nichols KK, Mitchell GL, Zadnik K. The repeatability of clinical measurements of dry eye. *Cornea.* 2004;23:272-285.
5. Nichols KK, Nichols JJ, Mitschell GL. The lack of association between signs and symptoms in patients with dry eye disease. *Cornea* 2004;23:762-70.
6. Meller D, Tseng SCG: Conjunctivochalasis: literature review and possible pathophysiology. *Surv Ophthalmol* 1998;43:225-232
7. Murube J: Characteristics and etiology of conjunctivochalasis: historical perspective. *The Ocular Surface* 2005;3:7-12
8. Schirra F, Hoh H, Kienecker C, Ruprecht KW: Using LIPCOF (lid- parallel conjunctival fold) for assessing the degree of dry eye, it is essential to observe the exact position of that specific fold. *Lacrimal gland, tear film and dry eye syndrome 2*, edited by Sullivan et al, Plenum Press, New York, 1998
9. Yokoi N, Komuro A, Maruyama K, Tsuzuki M, Miyajima S, Kinoshita S: New surgical treatment for superior limbic keratoconjunctivitis and its association with conjunctivochalasis. *Am J Ophthalm* 2003; 135:303-308
10. H h H., Schirra F., Kienecker C., Ruprecht KW.: Lid-parallel conjunctival folds are a sure diagnostic sign of dry eye. *Ophthalmologie* 1995 Dec;92(6):802-8
11. H h H, Schirra F, Kienecker C, Ruprecht KW: Lid-parallel conjunctival fold (LIPCOF) and dry eye: a diagnostic tool for the contactologist. *Contactologia* 1995(17): 104-117
12. Erd lyi B., Kraak R., Zhivov A., Guthoff R., N meth J.: In vivo confocal laser scanning microscopy of the cornea in dry eye. *Graefe's Arch Clin Exp Ophthalm* 2007 245: 39-44
13. Miller WL., Narayanan S., Jackson J., Bergmanson J.: The association of bulbar conjunctival folds with other clinical findings in normal and moderate dry eye subjects. *Optometry*, 2003 Sep;74(9):576-82
14. H h H., Schwanengel M.: Regression of lid -parallel conjunctival folds (LIPCOF) on topical treatment with Liposic Eye Gel: a pilot study. *Klin. Monatsbl. Augenheilkd*, 2006 Nov; 223(11):918-23
15. Dausch D, Lee S., Dausch S., Kim JC., Schwert G., Michelson W.: Comparative study of treatment of dry eye syndrome due to disturbances of the tear film lipid layer with lipid containing tear substitutes. *Klin. Monatsbl. Augenheilkd.* 2006 Dec; 223(12): 974-83
16. Lemp MA, Baudoin C, Baum J et al. The definition and classification of dry eye disease: Report of the Definition and Classification Subcommittee of the International Dry Eye Workshop (2007). *Ocular Surface* 2007; 5:75-92
17. Paugh, JR, Meadows D, Christensen M. The residence time of artificial tears in dry eye subjects. Paper presented at: American Academy of Optometry Annual Meeting; December 2005; San Diego, Calif. E-abstract #050062 (US Study)
18. Burton EW. *Trans Am Ophthalmol Soc* 1942; 40: 340
19. Miller D. *Arch Ophthalmol* 1967; 78: 328)

## REASONS TO CHOOSE SILICONE HYDROGEL LENSES

CHRISTINA N. GRUPCHEVA

Medical University Varna, Bulgaria

**Keywords:** *silicone hydrogel contact lenses*

We are heading towards the end of the last decade of the new Millennium. What happened for the past 10 years in the contact lens world? In one word – a revolution...

The old hydrogel material together with the old concept for water content is a history. The new key word is “silicone hydrogels”. This new word introduced completely new terminology in relation to water content and oxygen transmissibility. In the near past we believed that more water means more comfort, however, on the top of the recognized complications more water was associated with more dryness and more discomfort. The hydrogel materials have a property to “take” water from the environment including hydrating chambers and the tear film. Furthermore, when placed into the ocular surface the lens changes the unique structure of the tear film, dividing it into pre lens (lipid-water) and post lens (water-mucin) layers. This will result in faster water evaporation and lens dehydration. Then with high-water content this will also close a vicious circle when lens will dehydrate, and following its natural properties will take the water from the tear film, which will change further its structure and cause more evaporation...

To address those issues contact lens research and technology invented two new products – silicone hydrogels, and “water keeping” products. Silicone hydrogel lenses appeared to be a completely new concept. Firstly, in relation to oxygen transmissibility, there are critical parameters (permability and thickness) after certain value of which the oxygen can't penetrate better. At this value the oxygen concentration on both sides of the lens is with the same value. Does it mean that such a lens has no impact on the cornea after this critical value? NO! The motivation for this answer is the concept of oxygen flux and the mechanical properties of the lens. Oxygen flux is the amount of oxygen required by a given cornea at a particular moment, which means that to define this value we shall look at many variables most of which not measurable.

### Oxygen Consumption

Oxygen transmissibility (Dk/t) is the measurement of how much oxygen passes through a lens

of given thickness in the air. To address the issue of oxygen consumption a new measure – oxygen flux was introduced into the clinical research and practice. Oxygen flux is a measure of how much oxygen is available to the cornea when the lens is on the eye.

However, these measures do not show how much oxygen the corneal cells are metabolising. Total corneal oxygen consumption represents an index of corneal oxygen metabolism and thus cellular energy production<sup>1</sup>.

The oxygen flux, therefore, is judged by indirect clinical values as microcysts, microstriae, striae, corneal oedema and corneal neovascularisation. Silicone hydrogel lenses are providing extremely good transmissibility for oxygen, however, oxygen flux requires individual clinical judgment by the eye specialist. That is why all extended wear patients require very tight schedule for follow up. Oxygen deprivation impacts on all layers of the cornea. The epithelium thins, the stroma develops striae, the endothelium shows blebs and polymegethism, the conjunctival vessels dilate leading to hyperaemia. As health care professionals surely we should seek to minimise these effects.

### Oxygen Consumption Maps

The newer concept introduced by Noel Brennan, is the concept of percentage oxygen consumption. In this model, the actual amount of oxygen needed to ensure completely normal cellular activity underneath every part of the CL is calculated. In the case of the natural eye, every cell in the cornea will receive all the oxygen it needs to metabolise normally. This is also the case with 1 DAY ACUVUE® TruEye™, irrespective of lens power (higher minus lenses are thicker reducing potential oxygen delivery). Oxygen consumption across the entire cornea is not affected by the wearing of 1 DAY ACUVUE® TruEye™ irrespective of power.

The other problem is based on mechanical properties of the silicone-hydrogel lenses. There are many parameters most important of which are modulus, wettability, lubricity, dehydration, deposits, edge design and thickness. Unfortunately the design is not an universal property, as anterior ocular surface varies between subjects. Selection of a certain design is more or less empirical and is based on clinical performance and subjective appreciation of a given lens.

If the eye specialist wants to utilize SiH lenses,



they must follow few simple rules as follows:

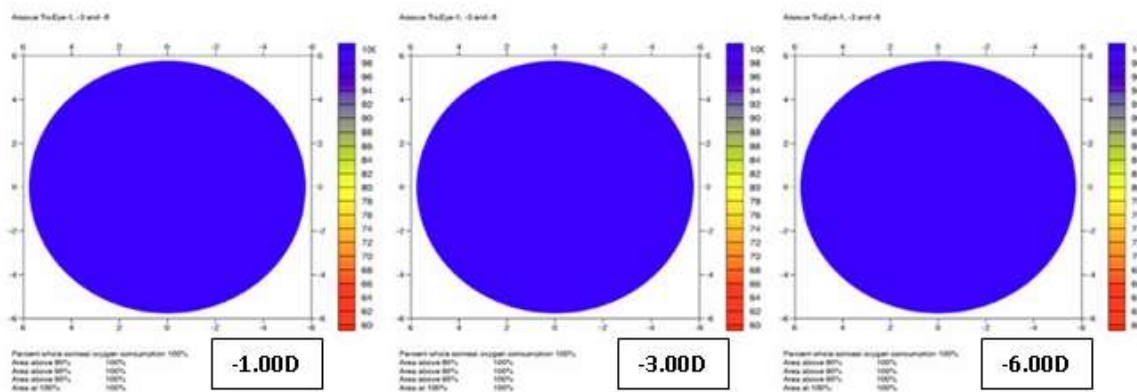
- Examine & listen to your patients with contact lens related dryness
- Ask patients about the number of hours of comfortable lens wear vs. total hours
- Be careful about patients reports regarding napping
- Pay special attention to patients working on a computer
- Remember: Contemporary tendency is lens wearers to be older, use more medications, spend more time in front of monitors and in air conditioned environment than in the past.

The contact lens world is changing very fast. The information via internet is instantaneous. All this globalization should impact contact lens habits. Before expecting our patients to change, we should change our minds, our fitting habits and our contact lens practices.

## BIBLIOGRAPHY

1. Brennan NA. Beyond flux: Total corneal oxygen consumption as an index of corneal oxygenation during contact lens wear. *Optometry and Vision Science* 2005; 82(6): 467-472

Courtesy of Brennan NA and Johnson and Johnson



# CORNEAL STAINING: DO WE UNDERSTAND WHAT WE ARE SEEING?

SILVIA BELCHEVA<sup>1</sup>, CHRISTINA N GRUPCHEVA<sup>2</sup>

<sup>1</sup>Private Practice, Bulgaria, <sup>2</sup>Medical University Varna, Bulgaria

**Keywords:** corneal staining, fluorescein, staining in contact lens wearers

Sodium fluorescein ('fluorescein') is widely utilised for the evaluation of ocular surface integrity. It is preferred for anterior ocular surface visualisation due to its fluorescent properties and its high visibility at low concentrations. Ocular surface fluorescence observed clinically is affected by a number of factors including concentration of fluorescein, thickness of the fluorescein layer, the wavelength of the exciting light source and whether or not a barrier filter is used as part of the viewing system. Three potential cellular mechanisms are involved in corneal surface fluorescence: surface pooling, uptake by cells and ingress around cells. Despite the widespread adoption of use of fluorescein for the assessment of the ocular surface, the clinical understanding and interpretation of corneal surface fluorescence is based upon clinical intuition rather than underpinning the basic causative mechanisms of this phenomenon, particularly important for contact lens wearers.

It is important to understand and to interpret the corneal staining in all cases of adaptation of contact lenses, including silicone hydrogel lenses. It demonstrates chronic injury of the corneal epithelium. The intact epithelium is the best protection against corneal invasion. Corneal staining means "clinical procedure allowing the observation of the vitality and integrity of the corneal epithelium cells using dye (fluorescein)". The observation of the corneal surface with the blue filter of the slit lamp after instillation of fluorescein allows visualisation of lesions with different localisation and importance.

## What is the value of staining in contact lens wearers and non wearers?

According to different clinical studies the corneal staining observed in patients non wearing contact lenses varies between 4 to 79% depending on the method. It is usually under first grade or if it is of first grade, is situated in the half of the cases in the inferior area of the cornea. It is a result of the impaired tear film. In 30 to 50% of contact lens wearers the staining is under second grade and in 5 to 10 % of them – above second grade. Corneal staining is usually asymptomatic, but must be a

part of the routine contact lens examination.

## Description and quantitative assessment of corneal staining

The description is according:

- Depth: superficial and deep;
- Localisation: the cornea is divided into five areas: central, superior, inferior, nasal and temporal.

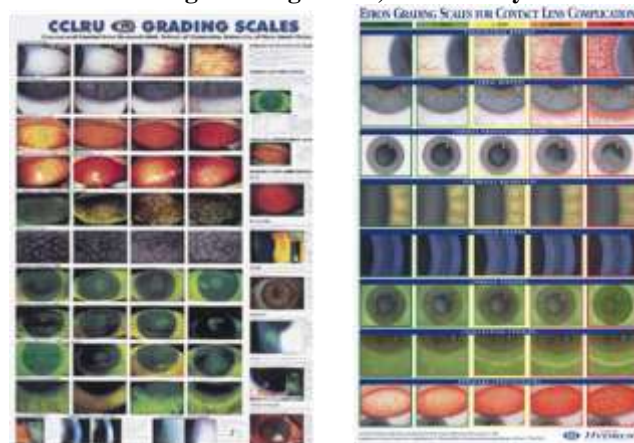


## Corneal staining grades

- grade 0 = no staining,
- grade 1 = micropunctate staining, clinically insignificant,
- grade 2 = macropunctate staining, it must be noted and followed up,
- grade 3 = moderate coalescent macropunctate staining, requires treatment,
- grade 4 = marked patch staining, requires immediate treatment.

The visual acuity is usually unaffected except for the central form of grade 4.

## Corneal staining Grading Scales, most widely used



### Clinical forms of corneal staining

- Punctate corneal staining: tiny superficial dots – keratitis punctata superficialis.
- Localised or diffuse staining of the cornea with coalescent dots.
- Staining at 3 and 9 o'clock, classical form of staining induced by hard contact lenses. A temporal and nasal staining is observed; the reason is the slow renewal of the tear film between two blinking.
- Staining like "smile": arched epithelial staining inferiorly between 4 and 8 o'clock, observed in soft contact lens wearers. It is related with instable tear layer between the lens and the cornea. It is observed in 3,3% of soft contact lens wearers.
- Superior arcuate epithelial lesion

This is frequent and asymptomatic complication of silicone hydrogel contact lenses. It is situated in the superior area of the cornea, covered by the upper eyelid at 2-3 mm of the limbus between 10 and 2 o'clock. The silicone hydrogel lenses must be replaced with lenses with lower modulus.

- Diffuse staining
- Peripheral staining
- Inferior and superior staining
- Limbal transition pooling

### Etiology

There are six known etiologies: mechanical, expositional, metabolite, infectious, toxic and allergic. However, in many cases the reason remains unknown.

- Mechanical factors

Defective lens, badly adapted (especially rigid lens) or badly maintained with deposits on its back surface, foreign body under the lens and other causes for microtrauma of the corneal epithelium.

- Expositional factors

Typically it reveals like an arcuate lesion (like smile) in the inferior third of the cornea and it is due to exposure of the corneal epithelium which causes dessication of epithelial cells. It is also observed in cases of upper decentration of rigid lens with diminished efficacy of blinking. Dry keratitis, related to dehydration of the lens, could be observed in wearing high hydrophilic soft contact lens. The staining presents with central localisation. The staining at 3 and 9 o'clock is related with this etiology as well.

- Metabolic factors

The wearing of soft contact lens could induce hypoxia followed by synthesis of lactic acid. This chronic metabolic stress leads to damage of deep cells of corneal epithelium with formation of microcysts. They produce superficial diffuse and always bilateral staining. The silicon hydrogel material allows to limit the hypoxia and consequently to reduce these metabolic problems.

- Infectious origin

A small corneal ulcer is usually observed (foreign body under the lens, inappropriate night wear), accompanied by corneal pain. The fluorescence is limited in the area of the lesion, but characteristic sign is the diffuse spread in the depth of stroma – posterior halo.

- Toxic and/or allergic etiology

Superficial keratitis, related to toxic and allergic reactions to components of maintaining products, are observed. The improvement of maintaining systems (lack of polyhexamethilen biguanide, PHMB, tiomersal, benzalkonium chloride, hexidine) should lead to disappearance of punctate lesions of the cornea.

### Is there a relation between corneal staining and bacterial keratitis?

Obviously, the breaking of the epithelial barrier of the cornea is "an open door" for infection, allowing adhesion and later penetration.

- By now the causative relation is not clearly proved.
- The role of multipurpose solutions for appearing of infections is not fully elucidated but it is always strongly recommended the use of products with minimal deleterious potential.

### Conclusions

- Corneal staining is a "must" evaluation for a good contact lens practice.
- Grading scales must be used to unify the findings and examination repeatability.
- Staining should be interpreted into the clinical context.
- Further corneal/contact lens solution interactions should be elucidated.

# LOWER BLEPHAROPLASTY: CONTOURING IN A SAFE APPROACH

STEFAN GRESS

Consultant Plastic Surgeon, Munich, Germany

## INTRODUCTION

Effective lower blepharoplasty is a challenging procedure that requires fundamental knowledge on anatomical structures of the orbital and periorbital region as well as surgical finesse and experience in facial plastic surgery. The fear of potential complications and pitfalls, e.g. postoperative ectropion, leads to inadequate approach to the problems present especially by young and less experienced surgeons.

This paper gives a guideline for a safe and effective technique to contour or reconstruct the lower eyelid.

## MATERIAL AND METHOD

Between 2004 and 2008 we have performed 285 lower blepharoplasties for aesthetic and reconstructive indications.

Aesthetic lower blepharoplasty was indicated to treat relaxation and redundancy of the lower eyelid skin, tear troughs or festoons, reconstructive indications included any malpositioning of the lower eyelid such as scleral show or ectropion for various reasons, e.g. trauma or following aesthetic surgery.

The routine technique utilized was a combination of techniques described by different authors, such as the *inferior retinacular lateral canthoplasty* (G. Jelks) (1,2,3), the *arcus marginalis release* (S.Hamra) (7) and *periorbital liposuction* (S. Coleman) (5,6).

### Pre Op Management

Routinely surgery was carried out in general anaesthetics as an outpatient procedure. For skin incision and coagulation we used a Radio Frequency Device (25 watt) and for illumination of the infraorbital rim a 300 watt xenon light source and a nasal light hook retractor. A cornea protection lens should be inserted. The infraorbital region was infiltrated with xylocaine 1% with epinephrine 1:100000. Antibiotics (cephalosporine) was routinely given for four days.

### Surgical technique

Access to the lower eyelid is carried out via a subciliar incision extended laterally when skin resection is required (Fig1). A transconjunctival approach is an option only if no skin redundancy is to be treated.

After infiltrating the lower lid with 1% xylocaine and epinephrine (1:100000) the skin is separated from the

muscle in a small strip along the pretarsal portion of the lower eyelid. A small muscle flap then is raised from the lateral portion of the preseptal orbicularis oculi muscle pedicled medially (Fig 2).

Figure no. 1. Subciliar incision



Figure no. 2. Medially pedicled preseptal orbicularis muscle flap



Further dissection is carried out directly supraperiostally along the infraorbital rim all along the way to the medial insertion of the orbicularis oculi muscle. A light hook retractor is inserted to facilitate the view (Fig 3). The entire inferior orbital rim is exposed (Fig.4). Preparation can be carried out by scissors or by a raspatorium. From medially to laterally the orbital septum is incised close to its insertion to the infraorbital rim (arcus marginalis release). First the nasal and medial orbital fat is gently pushed inferior over the orbital rim. It is placed beneath the nasal insertion of the orbicularis oculi muscle. The orbital fat is secured by two percutane stitches (4-0 Prolene) to prevent the fat from sliding back into the orbit (Fig 5,6,7). To avoid skin damage by the sutures, the nodes should be placed above a small piece of gauzes (Fig.8). The stitches are removed after four days.

Figure no. 3. Light hook retractor



Figure no. 4. Exposure of the inferior orbital rim



Figure no. 5. Orbital fat placed over the orbital rim



Figure no. 6 Orbital fat fixed by suture



If the amount of orbital fat is not sufficient to create a nice contour of the lower eyelid or when the orbital rim can not entirely be covered by orbital fat, additional fat grafting can be performed (lipostructure). The fat can be infiltrated from the subciliary approach or percutaneously by a sharp or blunt needle (Fig 9). However it should be placed above the periosteum and not above the muscle. Overcorrection should be avoided. The free fat grafts can be used to shape the entire cheek or midface whenever volume replacement is necessary.

The lateral infraorbital fat pad, when pushed over the orbital rim, is fixed by 5-0 Vicryl stitches.

Figure no. 7. Percutane fixation of the transpositioned orbital fat



Figure no. 8. Knod placed over gauzes



Figure no. 9. Percutane fat injection



Prior to skin resection, the lower eyelid needs to be secured and supported to avoid postoperative ectropion or scleral show. We utilize the technique of *Glenn Jelks*, the *inferior retinacular lateral canthoplasty*, which is more a canthopexy procedure:

The superficial lamella of the lateral canthal tendon is released at its lateral insertion to the orbital rim. The dissection is continued inferiorly in a subperiosteal plane until it joins the lateral-inferior edge of the orbit (that now is covered by the inferior lateral orbital fat pad). Fibrous attachments that run from the lateral canthus into the lateral inferior orbit are released to achieve free movement of the lower lid. The lower lid component of the lateral retinaculum (the component of the anterior lamella of the lateral canthal tendon that forms the roof the inferior lateral fat pocket) now is grasped and fixed vertically into the inner aspect of the supero-lateral orbital rim by a 5-0 Prolene suture (Fig 10,11). The elevation of the lower eyelid should appear slightly overcorrected.

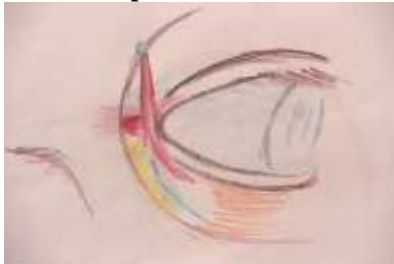
When canthoplasty is performed, the muscle flap raised at the beginning of the procedure is now fixed under moderate tension in an oblique superior direction to the periosteum of the lateral orbital rim by 5-0 Vicryl (Fig

12) sutures. Before skin removal, muscle incisions are closed by 5-0 Vicryl stiches.

**Figure no. 10. Suture passing through the lateral inferior retinaculum**



**Figure no. 11. Fixation of the lower lateral retinaculum to the supero-lateral orbital rim**



**Figure no. 12. Fixation of the muscle flap to the lateral orbit**



Excess skin can safely be removed now. This should be performed on open eyes to avoid overresection (Fig 13). For skin closure 6-0 Prolene is used.

A steri-strip dressing is applied using an additional long strip laterally to release tension of the cheek on the incision (Fig 14).

**Figure no. 13. Measuring skin excess prior to removal**



**Post Op management**

Stitches are removed after four days, however the steri- strip dressing should be continued 10- 14 days following surgery. Any tension on the cheek and lower eyelid should strictly be avoided for four weeks and the patient should sleep on his back during that period of

time. We routinely give cephalosporine antibiotics for four to five days

**Figure no. 14. Steri strip dressing**



**Complications**

The most common postoperative problem encountered is chemosis to various degrees. Chemosis is not treated actively, local steroids do not help significantly (Fig 15).

**Figure no. 15. Severe chemosis with haemorrhage**



Overresection of skin and hypertrophic scar formation can lead to malpositioning of the lower eyelid, e.g. to a round eye deformation, scleral show or ectropion. This is seldomly seen when the procedure is performed correctly and skin closure is carried out without tension. In some cases granulomas can occur around the permanent 5-0 Prolene suture that fixes the canthopexy. If these reactions lead to irritations of the globe or the patient feels uncomfortable, the suture can be removed after four weeks.

**RESULTS**

**Figure no. 16. 35 year old patient after lower lid contouring. Additional lipostructure of the cheek and midface was performed**



Figure no. 17. 75 year old patient following upper and lower blepharoplasty



Figure no. 18. 42 year old patient after contouring the lower eyelid and lipostructure of the nasojugal groove



Figure no. 19. 48 year old patient after contouring the lower eyelid and upper blepharoplasty



Figure no. 20. 68 year old patient after contouring the left lower lid malpositioning following a blow out fracture



## CONCLUSION

For contouring the lower eyelid, the combination of reshaping inferior orbital fat, fat grafting and muscle and skin tightening are all together effective tools to achieve functionally and aesthetically pleasing results in lower blepharoplasty. To prevent pitfalls and complications such as postoperative ectropion, a safe support of the lower eyelid is mandatory. Therefore we routinely utilize the *inferior retinacular lateral canthoplasty*, described by Glenn Jelks. We also utilize the “no touch technique” that does not allow complete transection of the orbicularis oculi muscle along the lower eyelid for better access to the orbit, because it would lead to denervation of the pretarsal portion of the orbicularis oculi muscle likely emerging into a round eye deformity.

When the guidelines presented in this paper are performed correctly, the lower blepharoplasty will be successful.

## REFERENCES

1. Jelks, G.W. The Inferior Retinacular Lateral Canthoplasty: A New Technique. *Plast. Reconstr. Surg.* 100:1262,1997
2. Jelks, G.W., and Jelks, E.B. Repair of lower lid deformities. *Clin. Plast. Surg.* 20: 417, 1993
3. Zide, B.M, and Jelks, G.W. *Surgical Anatomy of the Orbit.* New York: Raven Press, 1985
4. Muzaffar, A.R., Mendelson, B.C. *Surgical Anatomy of the Ligamentous Attachments of the Lower Lid and Lateral Canthus.* *Plast. Reconstr. Surg.* 110: 873, 2001
5. Coleman, S.R., Guerrerosantos, J. Volumetric Considerations in Facial Augmentation. *Journal for Aesthetic Surgery*, 2: 2003
6. Coleman, S.R., Facial recontouring with lipostructure. *Clin. Plast. Surg.* 24(2): 347, 1997
7. Hamra, S.T., The role of septal reset in creating a youthful eyelid- cheek complex in facial rejuvenation. *Plast.Reconstr. Surg.*, 113 (7): 2124, 2004