CORNEAL ENDOTHELIAL CELLS LOSS IN THE MYOPIC EYES DURING PHACOEMULSIFICATION

DAN MIRCEA STĂNILĂ1, ADRIANA STĂNILĂ2

Keywords: myopic eye, phacoemulsification, corneal endothelial cell loss

Myopia is a particularity of the ocular refraction with a special structure of the eye. The purpose of this paper is to show the loss of corneal endothelial cells in myopic eyes during phacoemulsification. The study included a number of 78 patients with medium and high myopia who were operated by phacoemulsification between 9th of January 2013 and 1st of October 2014. A number of 23 patients were selected to whom we measured through specular microscopy the corneal thickness and the endothelial cells density before and after surgery. In the myopic eyes loss of endothelial cells occurred with 118 more cells and cornea thickness grows with 7 microns. The loss of endothelial cells and the thickness of the cornea have changed more in the case of myopic eyes.

INTRODUCTION

Cataract is opacity in the normally transparent lens of the eye that can cause a decrease in vision. The phacoemulsification surgery is one of the frequently performed surgeries in ophthalmology. Myopia is a particularity of the ocular refraction with a special structure of the eye membranes.

METHODS

The study included a number of 78 patients with medium and high myopia who were operated by phacoemulsification between 9th of January 2013 and 1st of October 2014.

A number of 23 patients were selected in whom we measured, through specular microscopy, the corneal thickness and the endothelial cells density before and after surgery.

The associated myopia may modify the intraoperative and postoperative result. Anesthesia was topical in all cases.

RESULTS AND DISCUSSIONS

We examined the loss of endothelial cells and thickness of the cornea and compared the results with an anterior study on 80 patients which included all kind of ametropia and emmetropia.

The loss of endothelial cells in myopic eyes occurred with an average of 393 cells/mm² and the thickness of the cornea increased by 17 microns (figures no. 3 and 4)
In the category of myopic patients, with or without astigmatism, we took into consideration the patient’s option for postoperative refraction. Depending on the degree of myopia, the patients with a low degree of myopia between 1-5 diopters choose to become emmetropic; some patients with higher degree between 5-20 diopters, have chosen to remain myopic of 3-4 diopters.

A highly myopic eye can also have an unstable anterior chamber and mobile posterior capsule. The myopic eye has a large pupil, that is why it will be desirable a 6 mm square-edged optic implant. Amblyopia and posterior staphyloma can influence the good result.

In most of the cases, women are the ones who opted for a multifocal IOL in order to abandon glasses completely.

**CONCLUSIONS**

In comparison to the group with all types of ametropia and emmetropia, in the group of myopic eyes the loss of endothelial cells occurred with an average of 118 more cells and the thickness of the cornea grows with 7 microns. The loss of endothelial cells and the thickness of the cornea have changed more in the case of myopic eyes.

The cataract surgery in the presence of myopia, requires more attention, that is why biometry is a very important task for the preoperative assessment, the surgery and the postoperative care.

It is very important to take into consideration the option of the patients related to postoperative refraction.

**REFERENCES**

Myopia is the condition in which the patients depend of glasses for distant vision. Presbyopia is a “physiological” condition affecting every one of us, after the age of 40 and it has no relation with gender, race and anterior refractive condition (hyperopia, myopia, astigmatism). Presbyopia is one of the earliest signs of aging. The need for near-vision glasses makes the presbyopes feel “old for the first time” and sometimes, it comes as a shock.

As the world population is aging, the demand for a reliable presbyopia correction solution will also increase.

Worldwide presbyopia people:  
- 2005- 1.04 billion people;  
- 2010- 1.6 billion people;  
- 2020- 2.1 billion people are estimated.

Presbyopia (from the 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.

Each presbyopic patient is UNIQUE, so the doctors should have a broad spectrum of solutions.

The purpose of this paper is to show different possibilities for correcting myopia in people with presbyopia. Presbyopia correction myopic patients should be individualized according to the patient’ wish and activity. Monovision could be a solution.

Correcting presbyopia with contact lenses can be both rewarding and challenging. While somewhat dependent on the type of lens 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.

This was a retrospective study which took place in “Centrul Medical Dr. Stanila” eye clinic Sibiu, during 01 - 04. 2014. The mean age of participants was 52 years old (44-60 years). The group included 54 patients with myopia, 15 males, 39 females. We divided the participants into 2 lots depending of the visual correction option: A- 36 patients with glasses; B - 23 patients with contact lenses.

From the group A, we had 14 myopic patients corrected with 1, 2 or 3 pairs of glasses, for different distances, 6 with bifocal eyeglasses and 16 with progressive glasses.

From the group B, we had 6 patients with soft contact lenses corrected with monovision, 5 with modified monovision and 12 with multi-focal contact lenses.

The steps in prescribing a good correction for presbyopia in myopic patients should be:
1. A very good refraction  
2. Determining the distance power  
3. Determining the addition  
4. Determining the dominant eye (for example through +2.00Dsph test)

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**THE CORRECTION OF PRESBYOPIA IN THE MYOPIC EYES**

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*Keywords:* presbyopia, myopia

Abstract: Myopia is a refractive error in which patients are totally dependent on distance glasses. The aim of the study is to show different possibilities for correcting myopia in people with presbyopia. Presbyopia correction myopic patients should be individualized according to the patient’ wish and activity. Monovision could be a solution.
Testing the lens and vision with the multifocal trial 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 if necessary.
- Increase the minus in distance lens power
  - By -0.25Dsph in dominant eye or both eyes
  - Check subjective and objective improvement to distance vision
  - Check whether near vision remains 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”
- Increase the plus in distance lens power
  - By +0.25Dsph 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”

Monovision represents the art of science of fitting contact lenses in 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.

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.

Conclusions:
There are a lot of possibilities to correct presbyopia in myopic eyes.
Spectacles are still the first choice!
Monovision provides the simplest method of correcting both distance and near vision with contact lenses.

A more complex monovision approach uses a bifocal/progressive lens in one eye and a single vision contact lens in the other, so-called modified monovision.

For the correction of young myopic presbyopes success rate depends on: previous correction, occupation, motivation.

Presbyopes > 50yrs – in our opinion, the best solution is monovision correction - correcting the dominant eye for distance and the non dominant eye with a multifocal lens.

The correction of presbyopia in myopic patients must be individualized according to the activity and desires of the patients. Monovision is a solution.

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12. Sherman Winston Reeves, Monovision.
Dry eye syndrome is a multi-factorial disease resulting in dysfunctional tear film due to insufficient tear production quantity and/or quality, or increased tear film evaporation, potentially damaging the ocular surface. Epidemiological studies show wide differences in prevalence. Estimating the prevalence of dry eye disease is problematic because there is no consensus on diagnostic criteria.

The aging of the population is probably the most important factor because the incidence of dry eye increases with age. Changes in lifestyle can also bring into question, such as pollution, over-heated premises, air-conditioning and the use of the television or the computer screen. The stress of modern life is responsible for a high consumption of anxiolytic or other psychotropic medication.

A review of several large studies, conducted by the Epidemiology Subcommittee of the 2007 DEWS (Dry Eye WorkShop), showed that the prevalence of dry eye ranges between 5% and 30% in people aged over 50 years old.

Moreover, one in four people tend to endure the condition or to self-treat with over-the-counter products, without consulting a physician or obtaining a definitive diagnosis. It is also commonly accepted that the prevalence of dry eye disease is greater in women, especially after the menopause. Other studies show that 61% of sufferers experience symptoms on a daily basis, including 40% who encounter symptoms several times a day.

The DEWS (Dry Eye WorkShop) concluded that the true prevalence of moderate-to-severe dry eye lies somewhere close to the lower end of the range, whereas inclusion of mild or episodic cases would bring the estimate closer to the higher estimates reported.

### Table no. 1. Level of dry eye severity and discomfort

<table>
<thead>
<tr>
<th>Dry eye severity level</th>
<th>Discomfort, severity &amp; frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild and/or episodic; occurs under environmental stress</td>
</tr>
<tr>
<td></td>
<td>Moderate episodic or chronic stress or no stress</td>
</tr>
<tr>
<td></td>
<td>Severe frequent or constant without stress</td>
</tr>
<tr>
<td></td>
<td>Severe and/or disabling and constant without stress</td>
</tr>
</tbody>
</table>

Symptoms and signs of dry eye are various and subjective to each individual as each person will describe it in a different manner and may not be aware their symptoms constitute dry eye syndrome. But, in general, symptoms can be characterized as: discomfort (sensation of foreign bodies, burning, tired eyes, eye pain, etc.), environmental intolerance as well as contact lens intolerance.

The subjective signs of dry eye are non-specific and evoke those of a chronic conjunctivitis (figure no. 1). The most frequent complaints of patients that suggest the possibility of a dry-eye syndrome are: red eye, problems with vision (blurred vision), eyelids glued together upon waking in case of blepharitis, photophobia, etc. In the case of “Sjogren syndrome dry eye”, other signs occur such as a dry mouth.

These symptoms are exacerbated by environmental factors: low humidity and constant air flow such as air conditioning. The symptoms range from mild forms of discomfort to disabling forms.
The importance of the complaints is not always correlated with the severity of the objective signs, especially in the chronic form of the disease because of corneal sensitivity reduction. A ophthalmological examination is therefore required.

Examination signs are also non-specific, but they will help to judge the objective impact of dry eye. The eye examination with fluorescein and the slit lamp reveals conjunctival irritation signs, corneal impact signs, a scarce, immobile dirty tear film, which may be loaded with mucous filaments or frothy secretions, punctuated superficial keratitis and ulcerations. The possible association with a dry mouth needs to be checked, which can orientate the symptoms towards a medicinal cause or a dry syndrome.

Patients with dry eye most commonly complain of a sandy-gritty feeling or burning that becomes worse as the day progresses. At night the eye surface has a chance to recover. With eye opening, evaporation begins, and as the day progresses, evaporation pulls further and further ahead of tear production. For this reason, the symptoms increase as the day proceeds. In meibomitis (Inflammation of the meibomian glands) patients, the symptoms are worse upon waking in the morning. At night the inflamed eyelids are up against the cornea, tear secretion decreases, and inflammatory mediators have all night to act negatively on the surface of the eye. Because this is an inflammatory condition, patients may frequently complain of eye redness in the morning. As tear film evaporation then increases over the day, these patients develop a second peak in their symptoms late in the day.

The impact on the quality of life of a patient with dry eye is an important concept to keep in mind and even more importantly, the impact is not always correlated with the severity of the lesions reported. The spontaneous evolution of the disease may lead towards the emergence of corneal complications, such as erosions, ulcerations that are often torpid, keratinisation and limbocorneal neovascularisation (figures no. 2 and 3). All of them could result in blindness in extreme cases.

Dry eye is associated with a measurable adverse impact on several common and important tasks of daily living, further implicating this condition as an important public health problem deserving increased attention and resources. Dry eye can have a significant impact on visual function that can diminish a person’s quality of everyday living. More specifically, crucial daily activities of modern living such as reading, computer use, professional work, driving, TV watching, staying out with friends at dinner parties and enjoying outdoor activities are all negatively impacted by dry eye. In general, visual function and quality of life are important outcomes in the evaluation of therapeutic decisions as well as in the assessment of the economic and public health impact of any ocular condition.

Table no. 2. Dry eye grading

<table>
<thead>
<tr>
<th>Dry eye severity level</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discomfort, frequency</td>
<td>Mild episodic; occurs under environmental stress</td>
<td>Moderate episodic or chronic, stress or no stress</td>
<td>Severe frequent or constant without stress</td>
<td>Severe and/or disabling and constant</td>
</tr>
<tr>
<td>Visual symptoms</td>
<td>None or episodic mild fatigue</td>
<td>Annoyng and/or activity-limiting episodic</td>
<td>Annoying, chronic and/or constant, limiting activity</td>
<td>Constant and/or possibly disabling</td>
</tr>
<tr>
<td>Conjunctival injection</td>
<td>None to mild</td>
<td>None to mild</td>
<td>Moderate to marked</td>
<td>Marked</td>
</tr>
<tr>
<td>Conjunctival staining</td>
<td>None to mild</td>
<td>Variable</td>
<td>Marked central</td>
<td>Severe punctate erosions</td>
</tr>
<tr>
<td>Corneal staining</td>
<td>None to mild</td>
<td>Variable</td>
<td>Marked central</td>
<td>Severe punctate erosions</td>
</tr>
<tr>
<td>Corneal/tear signs</td>
<td>None to mild</td>
<td>Mild debris, ↓ meniscus</td>
<td>Filamentary keratitis, mucus clumping, ↑ tear debris</td>
<td>Filamentary keratitis, mucus clumping, ↑ tear debris, ulceration</td>
</tr>
<tr>
<td>Eyelid/meibomian glands</td>
<td>MGD variably present</td>
<td>MGD variably present</td>
<td>Frequent</td>
<td>Trichiasis, keratinization, symblepharon</td>
</tr>
<tr>
<td>TFBUT (sec)</td>
<td>Variable</td>
<td>10</td>
<td>≤ 5</td>
<td>≤ 5</td>
</tr>
<tr>
<td>Schirmer score (mm/5 min)</td>
<td>Variable</td>
<td>10</td>
<td>≤ 5</td>
<td>≤ 2</td>
</tr>
</tbody>
</table>

*Must have signs AND symptoms. FBUT, fluorescein tear
The dry eye grading according to disease severity is based on the Delphi Panel Report. It was adopted, modified, and is recommended by the International Dry Eye WorkShop (DEWS). At the end of 2007, the DEWS (Dry Eye Workshop) report updated the definition of dry eye syndrome and provided additional insights into the cause of the disease. Recognition of the role of primary inflammation and osmolarity in the initiation and progression of the disease did a lot to increase the profile of dry eye; however, the DEWS report did very little to simplify and clarify the diagnosis, classification, or treatment of dry eye.

### Table no. 3. Main factors causing dry eye

<table>
<thead>
<tr>
<th>Default in spreading / Increase in evaporation</th>
<th>Palpebral anomaly</th>
<th>Ectropion, Lagophthalmus, Shrinking scar.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disfunction of the primary or secondary Meibomian glands</td>
<td>Chronic blepharitis, rosacea, seborrhoeic dermatitis, chronic allergy</td>
<td></td>
</tr>
<tr>
<td>External causes</td>
<td>Air-conditioning, ventilation, pollution, tobacco, excessive heating, prolonged fixation (working on the computer screen, driving, etc.), wearing contact lenses</td>
<td></td>
</tr>
<tr>
<td>Decrease in secretion</td>
<td>Lacrimal alteration</td>
<td>Age, Hormonal changes (menopause, androgen deficiency), Trauma (surgery), inflammation, infection, autoimmune diseases (Gougerot-Sjögren syndrome), refractive surgery, Vitamin A deficiency.</td>
</tr>
<tr>
<td>Blockage of the reflex secretion</td>
<td>Refractive surgery, contact lenses, local anesthetics.</td>
<td></td>
</tr>
<tr>
<td>Medication causes</td>
<td>Anxiolytics, antidepressants, neuroleptics, antihistaminics, beta-blockers, diuretics, retinoids.</td>
<td></td>
</tr>
</tbody>
</table>

When an alteration of tear film occurs due to various physiopathologic factors, qualitative and quantitative alteration of tears is registered in association with tear hyperevaporation and reduced tear clearance. These factors lead to a hyperosmolality of tear film, that in turn triggers the irritation of ocular surface.

Until this stage, we could use the tear substitute. A tear substitute is designed to break the cascade of dry eye by supporting and rebalancing the tear film for as long as possible to prevent the vicious cycle.

### Figure no. 4. Tear substitutes

Tear substitutes constitute the basis for the treatment of any dry eye. Several theoretical objectives of these tear alternatives exist:
- Supplement and rebalance the tear film for as long as possible.
- Preserve patients comfort and quality of life.
- Ensure the formation of a functional film and preserve visual function.
- Increase the volume of tears.
- Moisten and lubricate the corneconjunctival surface.
- Replace the mucous layer deficit and stabilise the tear film.
- Reduce the tear osmolarity by a dilution effect.

To do so, the eye drops must have a very high tolerance, a strong affinity for the corneoconjunctival surface, a prolonged contact time and the lowest viscosity possible. Depending on the severity of the disorder, the treatment is artificial tears using saline solutions, polymers, dual polymers or composition of polymers + electrolytes + nutrients. Saline solutions are recommended for mild dry eye, polymers and composition of polymers are recommended for mild to severe dry eye.

### REFERENCES


DRUG TREATMENT OF MYOPIA

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Keywords: myopia, eye disorder, drug treatment

Abstract: Myopia is a common eye disorder. There are over 1 billion cases worldwide. The World Health Organization (WHO) states that refraction defects are among the top 5 causes of low visual acuity that can be corrected. Studies have shown that a number of pharmacological agents may slow down the progression of myopia, especially in children. Also, certain substances are used to slow down or eliminate choroidal neovascularisation which occurs in cases of degenerative myopia.

Myopia is a common eye disorder. There are over 1 billion cases worldwide. The World Health Organization (WHO) states that refraction defects are among the top 5 causes of low visual acuity that can be corrected.

Pharmacological agents in Myopia:

- **Atropine**
  - Non-selective muscarinic antagonist
  - Administering 1 drop of atropine 1% 1x / day (at night) for 2 years resulted in a progression of myopia of -0.28 D (in the placebo group – the progression was -1.20 D)
  - “Atropine for the treatment of childhood myopia” Chua WH, Ophthalmology 2006 - 400 patients
  - Other studies have shown that a concentration of 0.5% is effective. But, it causes mydriasis, photophobia, blurred vision.

- **Pirenzepine**
  - Selective muscarinic antagonist
  - Mydriatic and cycloplegic effect is minimal
  - Administering the gel in a concentration 2 %, 2x / day showed an increase in myopia by 0.58D after 2 years (placebo - an increase by 0.99 D)
  - Two-year multicenter, randomized, double-masked, placebo-controlled, safety and efficacy study of parallel 2% pirenzepine ophthalmic gel in children with myopia - Siatkowski RM, J AAPOS 2008-117 patients

- **Bevacizumab**
  - For choroidal neovascularisation in pathologic myopia
  - Improves eyesight
  - It was found that chorioretinian atrophy occurs with time, but this is due to lesions specific to myopia

There are also several natural remedies that help maintain eye health

- Administering natural supplements to patients with myopia helps improve scotopic vision, contrast sensitivity and chromatic sensitivity

- **Anthocyanosides**
  - Bilberry (Vaccinium myrtillus) extract
  - They are inserted in the photochemical mechanisms of vision

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AMT, vol. 20, no. 1, 2015, p. 9
Neutralize free radicals
Inhibitory effect on the enzymes that are involved in the release of inflammatory mediators
Anthocyanosides - action on different levels (3)

Figure no. 2. Anthocyanosides - action on different levels

Anthocyanosides improve scotopic threshold for myopic patients (2)

Figure no. 3. Myopic patients

Anthocyanosides improve retinal sensitivity in patients with mild and severe myopia
- 4 patient groups (normal, mild, average and severe myopia)
- Treatment with 320 mg of anthocyanosides / day for 3 months
- All groups showed an improvement of the ERG response but the differences were statistically significant for patients with mild and severe myopia - possibly due to vascular alterations in these cases (1)

Supplements in myopia

<table>
<thead>
<tr>
<th>Vitamin E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lutein, zeaxanthin, astaxanthin</td>
</tr>
<tr>
<td>Strong antioxidant effect</td>
</tr>
<tr>
<td>Help maintain the stability of retinal pigment epithelium</td>
</tr>
</tbody>
</table>

Selenium
| Strong antioxidant effect |
| Increases the effect of vitamin E |

In conclusion, various pharmacological substances as drops, tablets, syrups or intravitreal injections may be beneficial in:
- Stopping the progress of myopia
- Improving choroidal circulation and preventing neovascularisation
- Preventing complications

REFERENCES

Preoperative evaluation of myopic patients for cataract surgery

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Keywords: cataract surgery, preoperative evaluation, myopic eye

Abstract: The paper presents aspects of preoperative assessment for cataract surgery in a myopic eye. There are analyzed various methods of biometric calculation, the possibilities to evaluate the macular function and retinal status. Type of cataract, zonular integrity, presence of posterior vitreous detachment, the appearance and the number of endothelial cells, the presence of eye disorders associated can have implications on the intra- and postoperative evolution.

Myopia is a spherical ametropia where the parallel rays of light focus in one point in front of the retina.

Optic classification:
• axial myopia: an increase of the axial length by 0.4 mm corresponds to 1D, with normal lens and cornea;
• curvature myopia: by normal antero-posterior diameter, with augmented corneal curvature or intumescent lens;
• index myopia: modified refraction index (nuclear cataract)

Clinical classification:
• low myopia: under – 3D;
• medium myopia: -3 – 6D;
• high myopia: over -7D;

Simple myopia is rarely present in the newborn. It is revealed at the age of 5-6 years old and it has an evolution generally till 19-20 years old, when it gets stable. It does not present posterior pole complications. Symptoms: blurred distance vision, accommodative asthenopia.

Degenerative myopia reaches high values of Diopters (to -30D) because of the progressive character and of the distortion of the globe. Visual acuity becomes worse when posterior lesions occur. It is often accompanied by divergent strabismus with binocular vision impairment. Visual field alterations appear: concentric narrowing, enlargement of the blind spot. Posterior staphylomas come with quadrant defects.

The distortion of the globe produces alterations of the choroid a retina, with visual consequences: Bruch membranes ruptures, thinning of the pigmented epithelium and of the choroid in the macular region, tilted optic nerve, posterior staphyloma, subretinal hemorrhages, choroidal neovascularization, macular serous detachment, Fuchs spot, periphery retinal degenerations, vitreous degenerations.

Complications: retinal detachment, posterior subcapsular cataract, open angle glaucoma, macular whole, retinal and choroidal hemorrhages.

Cataract in myopic eyes has few particularities, but the cataract surgery in myopic eye raises special problems. Posterior subcapsular cataract is specific to high myopia. First of all, the lens implant, through the modification of the refraction, has a special effect for the former eyeglasses wearer. The dipotric value of the implant must be carefully chosen. The visual rehabilitation depends on the preoperative status of the eye.

The surgery itself has some particularities due to the zonular and capsular weakness, the dimension of the lens, the refraction of the cornea.

Preoperative evaluation

The anamnesis must establish the presence of any possible associated local disease or treatments (glaucoma, retinal detachment, trauma) or general (diabetes mellitus, hypertension, chronic treatments with antithrombotics, anticoagulants etc.).

The visual function must be assessed (if possible) to establish the functional postoperative prognosis. Best corrected vision acuity and visual field could be useful if possible to be examined. If not, ERG and EOG could be performed. Colour sense is affected in blue-yellow axis, light perception can be altered (hemeralopya), contrast sensitivity suffers in macular alterations.

The split lamp exam of the anterior pole in (after mydriasis) must reveal the type and the localization of the opacities, the density of the nucleus, the presence of eventual zonular defects, the depth of the anterior chamber. The presence of a pupilar defect could indicate an optic nerve defect. The posterior pole exam will evaluate the macula region (macular lesions), the retina (retinal degenerations, chorio-retinal atrophy, ruptures, detachments), the vitreous (detachments, liquefactions), the choroid (myopic chorioidosis, neovascular membranes, hemorrhages, pigmentary placards), the optic nerve (myopic conus, posterior staphyloma).

Complementarily, there could be used other examinations in order to evaluate the status of the eye: angiofluorography, OCT (for the posterior pole), corneal topography (to appreciate corneal astigmatism in order to make the best choice of the implant, and to perform the best located incisions), pachimetry (to perform the right manoeuvres according to the existing endothelial cells).

Establishing the postoperative refractive target represents a challenge before the cataract surgery in myopic eyes.
Majority of the myopic patient chose to maintain near vision. The general chosen refractive target is low myopia (-2.5/-3D).

A posterior staphyloma could bring errors to 4-6 D. The length of the antero-posterior axis is important. A length higher than 26 mm requires the use of SRK-T formula. High dimensions of the anterior chamber may require an implant with bigger optical part (6 mm).

The risk of developing a later retinal detachment which will require vitreo-retinal surgery with silicone oil tamponade will make the choice of an acrylic implant and not siliconic (which could interact with the oil).

REFERENCES
CATARACT SURGERY COMPlications IN MYOPiC PATiENTS

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1,2Lucian Blaga” University of Sibiu, 3,4,5Clinical County Emergency Hospital Sibiu

Keywords: cataract surgery, complications, myopic patients

Abstract: Cataract surgery in myopic patients involves additional intra- and postoperative risks, compared with emmetropic eyes. The cases have been analyzed from the intraoperative peculiarities perspective, but also from the point of view of subsequent development. Clinical correlations have been established between associated local and general pathology and the visual function evolution.

PURPOSE

The study analyses the cataract cases regarding the intraoperative particularities, further evolution, establishing correlations between the associate pathology and the evolution of the visual function.

METHODS

We analyzed 114 cataract cases in myopic eyes, operated by phacoemulsification with posterior chamber implant.

• Low myopia – 61 cases
• Medium myopia – 33 cases
• High myopia – 20 cases

We followed up intra- and postoperative particularities.

RESULTS AND DISCUSSIONS

Anesthesia

The first important moment of the cataract surgery is the anesthesia. In most cases, the surgery of the lens is performed in local anesthesia (topical or parabulbar). The main disadvantage of local anesthesia is that the patient may move during the operation. Most of these movements are related to speaking, coughing, anxiety. A special attention has to be paid to the patient suffering of debilitating diseases, Parkinson, chronic coughing etc. A sudden, unexpected move can impair the surgery. Excessive sedation (sleep) can also be dangerous. The patient can awake suddenly, bewildered, violently moving the head, which could cause serious intraocular damages. A permanent communication with the patient will maintain his attention awake.

The closed system offered by phacoemulsification is of great advantage when excessive movements occur. Due to the small incisions, the operation can be resumed at any moment after the discomfort of the patient was solved or even the next day. The most delicate moment is to perform the capsulorhexis. A sudden movement can cause the sideslip of the rhexis.

Parabulbar or retrobulbar anesthesia in myopic eyes has a higher risk of perforating the globe due to its dimensions. Photophobia present in some myopic eyes can contraindicate the topic anesthesia because of excessive movements.

We used topic anesthesia in most of our cases (84). In 24 of these, there where uncontrolled movements present. In 8 cases, we found subconjunctival hemorrhage on the 2nd day because of the fixation of the conjunctiva. In 19 cases of these, the operating time was longer than the average.

Parabulbar anesthesia was avoided in the patients with hemorrhagic risk (anticoagulants, antiagregants).

Incisions

The incisions are extremely important first of all for the good evolution of the surgery. The handling of the instruments depends on the construction and the position of the incisions. The immediate and late evolution of the wounds depends also on the incisions.

The incision has 3 components (figures no. 1, 2):

• External incision
• Tunnel
• Internal incision

The depth of the external incision must be carefully performed. An insufficient depth (although it allows the easier handling of the instruments) can be too fragile and can be wounded by the instruments. An increased depth (although it offers a more resistant roof) can determine instability of the wound with postoperative foreign body sensation.

A bad incision can transform an easy case in a difficult one as well as a good incision can assure a good evolution of a difficult case.

The main problems raised by the construction of the incisions which can cause complications are:

• External incision located anteriorly or posteriorly
• Internal incision located anteriorly or posteriorly
• Premature penetrating of the anterior chamber
• Too deep or too superficial tunnel
• Too large or to narrow incision

In myopic eyes, with high myopia, there is preferred a short tunnel to avoid intraoperative deformation of the cornea, with bad visibility in the anterior chamber. A too short tunnel could be difficult to seal because of the small flap.
In all cases, we obtained a good sealing of the wound without suturing.

A too short tunnel can disturb the stability of the chamber during the surgery.

In 7 cases, we had some fluctuations of the anterior chamber without further complications.

In all cases of high myopia, there were some small alterations of the visibility.

Performing the capsulorhexis represents one of the most important maneuvers of the cataract surgery. It requires maximum attention. The rhexis line must be continuous and its diameter must have the right size for the phacoemulsification (figures no. 3,4). A too large diameter risks sideslipping. A too small diameter makes too difficult the hydrodissection and the rotation of the nucleus.

In 9 cases we performed a normal dimensioned rhexis but too small compared to the volume of the lens. The handling of the lens masses became difficult due to the too narrow bag. In 9 cases of high myopia the rhexis was larger than normal, but proportional to the volume of the lens. The mobilization of the masses was easy, but we experienced some problems with the centration of the IOL. In 2 cases of these, we observed a slight decentration the 2nd day.

The phacoemulsification of the nucleus and epinucleus, the aspiration of the cortex does not present special features in myopic eyes (figure no. 5). The deep anterior chamber in myopic eyes provides a certain safety of the manipulation of the masses far away from the endothelium. The deep chamber can raise some problems in viewing the bag, requiring permanent adjustments of the microscope. The fragility of the zonula requires great attention during the maneuvers.

In 5 cases, we observed small lens particles in the anterior vitreous, passing through the lax zonulla (figure no. 6).

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In 5 cases, we observed small lens particles in the anterior vitreous, passing through the lax zonulla (figure no. 6).
Postoperative corneal edema was according to the number and health of the endothelial cells and to the phaco time.

In myopic eyes we observed a smaller edema compared with similar endothelium or phaco time in non myopic eyes. We had transient edema (under 7 days) in 8 cases (figure no. 7).

**Figure no. 7. Corneal edema**

*Visual acuity*

The choice of the Diopters of the IOL is a challenge in myopic eyes. Generally, the patient chose an implant for near vision, maintaining distance correction. The rehabilitation of the visual function depends mainly on the preoperative status of the retina and optic nerve, but also on the biometry.

In 87 cases, BCVA was 20/20 after the surgery. In the rest of the cases, there were chorioretinal degenerations (6 cases), ARMD (11 cases), diabetic retinopathy (7 cases), diabetic retinopathy + ARMD (3 cases).

**CONCLUSIONS**

- Cataract surgery in myopic eyes involves additional intra and postoperative risks comparative to emetropic eyes.
- Topical anesthesia is preferred in myopic eyes.
- The course of the surgery (cameral fluctuations, visibility of the chamber, wound sealing) depends on the architecture of the incisions.
- The capsulorhexis should be adapted to the volume of the lens but it should not exceed the optical part.
- Postoperative edema is reduced comparative to emetropic eyes.
- Visual acuity depends on the associated pathology.

**REFERENCES**

OCULAR PATHOLOGY INDUCED BY COMPUTER

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Keywords: ocular syndrome related to computer

Abstract: Ocular syndrome related to computer includes several symptoms generated by a continued focus for a certain period of time on a computer screen. The study was based on 85 cases, users of computer. We analyzed the presence of CVS symptoms, the correlation between the pathology of accommodation and the way of using the computer.

INTRODUCTION

The ocular syndrome related to computer brings together more symptoms generated by a continued focus for a certain period of time on a computer screen. It is estimated that it affects over 90% of people who use the computer for more than 3 hours / day. The symptoms are: headache, changes of visual acuity, fatigue, ocular or periocular pain, conjunctival hyperemia, foreign body sensation, diplopia, vertigo, dizziness, neck and back aches.

Causes:

Related to ocular refraction:
- Presbyopia
- Accommodative asthenopia, accommodative spasm
- Uncorrected/wrongly corrected refractive errors

The dry eye syndrome

Related to the screen display:
- Clarity
- Lighting
- Brightness
- Contrast
- Body posture and sight direction

The environmental conditions - light, temperature, humidity

Presbyopia and computer:
Presbyopia has a negative impact on the computer’s users. The correction for reading (25-30 cm) does not always correspond to the correction required for the computer. The computer display is located at a longer distance, 40-80 cm, so the correction is:
- too strong for the screen
- too weak to read

This generates ocular pain, headaches, computer tiredness, distress.

Accommodative asthenopia and the computer:
The focus on a computer screen without interruption leads to ciliary muscle fatigue. An improperly corrected presbyopia and hypermetropia emphasize tiredness. To avoid the asthenopy, it’s necessary:
- optimal correction of the sight defect

Accommodation spasm and the computer:
A prolonged use of computer can cause accommodation spasms with:
- decreased vision at distance (initial transient, especially in the 2nd half of the day, then permanently)
- tiredness

1 in 6 young people who use the computer daily shows at some time accommodative spasm symptoms

Dry eye and computer:
Working at the computer can cause dry eye syndrome because of:
- the rate of blinking is decreasing due to focusing on the screen (normal range of blinking is 2-10 sec.; while reading it can increase 3-4 times) - film evaporation with dry eye sensation
- high position of the screen - a wider opening of the eyelids
- the environment (air conditioning, air currents etc.)

Dry eye syndrome has a high prevalence in the general population, for various reasons (age, meibomian dysfunction etc.). The computer work

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Dry eye syndrome has a high prevalence in the general population, for various reasons (age, meibomian dysfunction etc.). The computer work
either generates a dry eye syndrome or increases an existing one.

Treatment:
- avoiding the risk factors
- increase of the blink rate
- proper positioning at the office desk
- replacement - artificial tears
- reducing ocular inflammation
- increasing the retention of tears – blocking the lachrymal points

The display of the screen:

Watching on a display is different than reading a printed page:
- poorly defined contrast of the letters compared to the background
- glow, the reflections of the screen
- the distance from the screen is longer than the one from a book
- font size is variable
- the sight direction may be incorrect
- the amount of information is usually very big

Shaking (flicker) images (in cathode ray tube monitors) and slightly blurred images overlapped incorrectly generate a false interpretation of the image by the brain (similar to diplopia) and the result consist of abnormal eye movements in attempt to redress the false diplopia and ocular periorcular pain, headache, blurred vision.

RESULTS AND DISCUSSIONS

We analyzed the presence of ocular pathology related to computer use in correlation with the time spent in front of the computer, age and preexisted refractive errors.

PURPOSE

A questionnaire was filled out by 85 people, from urban area, aged between 24 and 58 years old with a working time on computer of: 3-9 hours/day, >3 years.

METHODS

The symptoms of accommodative asthenopia were found in 22 cases, of which:
- 18 persons > 40 years, presbyopics, without others refractive errors; the most likely cause is the inadequate optical correction of presbyopia
- 4 persons < 40 years, without known refractive errors

The symptoms of accommodative spasm were found in 30 cases (36%).
- 22 persons < 40 years old - “frequently”
- 8 persons > 40 years old – “sparse”

Computer work > 3 h / day and age <40 years are risk factors for accommodative spasm.

All people surveyed reported the presence of dry eye symptoms.

Dry eye symptoms: gritty sensation in the eyes, photophobia, conjunctival congestion
- 47% of those who use PC 3-6 h/day - sparse
- 50% of those who use PC 6-9 h/day – frequently

The symptoms were increasing with the number of hours spent at computer.

Dry eye symptoms were found at all ages with an increase after the age of 40 years, because of the association of the “computer” risk factor and the “age” risk factor

30% of people surveyed said they were disturbed by the screen brightness, luminosity, weak contrast.

CONCLUSIONS

- the symptoms of ocular pathology related to computer use those who use the computer for a long time (more than 3 hours/day, more than 3 years)
- accommodative asthenopia is common, especially in people over 40 years (presbyopic)
- accommodative spasm is more common in younger people (<40 years)
- the symptoms of dry eye syndrome are present in different forms in all computer users and these increase with age, probably in combination with other risk factors
- display features contribute to dry eye symptoms
- therefore, to reduce the symptoms, it is required:
  - to avoid prolonged focus on the screen (break the focus to infinite every 20-30 min.)
  - optimal correction of presbyopia
  - optimal correction of refractive errors (after cyclopia)
  - conscious blinking at every 10-15 sec.
  - the screen position with 15-20 degrees below the eyes
  - treatment of dry eye syndrome
  - screen contrast and brightness adjustment

REFERENCES

There are stories about the ancient Chinese method of sleeping with small sand bags on the eyes to reduce myopia. The first ophthalmologist who attempted to modify corneal curvature in keratoconic patients by using flat-fitting glass scleral contact lenses was Eugene Kalt, in 1888.(1) Only much time later, in the 1950s, after the introduction of polymethyl methacrylate (PMMA) corneal contact lenses, practitioners began to notice corneal distortion of decentered lenses and the possibility of deliberately manipulating corneal shape with contact lenses to modify refractive error began to be recognized. In the ’50s and ’60s, a lot of interest was addressed to the observed CL-induced refractive changes, but the “father” of modern orthokeratology is considered to be George Jessen. In 1962, he reported on his “deliberate effort” (his orthofocus techniques) to harness these changes beneficially (for both myopia & hyperopia) and founded the Society of Orthokeratology.(2,3) The lenses used in order to induce a controlled distorsion were large diameter PMMA lenses of conventional design, fitted flatter than K, progressively changed in small steps. Lenses showed poor centration and were worn during the day, allowing a period of improved unaided vision in the afternoon and evening. Treatment often took weeks to months and the early studies concluded that the mean reductions in myopia were significant, but modest and the clinical outcomes from OK were variable and unpredictable.(4)

Jessen’s hypothesis was that the ideal lens was a “reverse geometry” contact lens, flatter in the centre in order to flatten the corneal apex and steeper in the periphery for centration, but technology was still limited at the time. Fontana in 1972 (5) made some advances, but the introduction of the reverse geometry lens design in the modern era was done by Richard Wlodyga and Nick Stoyan (6,7), in the early 1990s. They described a novel OK lens design for “Accelerated Ortho-K” which improved centration and produced a rapid and stable change in corneal curvature with fewer lenses required, often one pair only. The development of sophisticated computer controlled lathing methodologies allowed easy fabrication of the complex back surface design and high reproducibility.

In the 1980s, there also took place the development of rigid gas-permeable (RGP) lens materials and by the end of the decade a range of rigid lens polymers with high oxygen permeability (Dk) were available and allowed closed-eye lens wear. Overnight OK minimizes the need for adaptation, reduces discomfort, maximizes effect and is more convenient for the patients. At the same time keratometers were replaced with corneal topographers, some with lens fitting software, offering a better understanding and follow-up of the fitting. Nowadays, the four- or five curve reverse-geometry lenses in high Dk materials in an overnight lens-wearing modality for the correction of low to moderate myopia are widely used all over the world.

Orthokeratology effects
The most important effect is the significant change in corneal curvature, accompanied by topographical change in corneal thickness: primarily epithelial central thinning, mid-peripheral thickening and possible alteration to corneal sagittal height.

According to Caroline Cho studies (8), the flatter central fitting relationship results in a positive pressure or applanating force on the cornea. The thin tear film beneath the centre of the lens (5 μm) creates thin-layer shear forces beneath the lens that move tangentially across the epithelium. The flat
lens-to-cornea fitting relationship induces a possible compression and/or redistribution of the corneal tissue.

The possible mechanisms for myopia correction are: corneal “bending”; epithelial thinning (centre) by compression and decrease in number of cell layers, epithelial thickening (mid-periphery) by cell enlargement and increase in number of cell layers; tissue redistribution (cell migration, retention, sloughing or mitosis); stromal thickness (location dependent), water movement/cell dehydration.

The refractive error change can be predicted on the basis of corneal thickness changes alone. (9) When applying the Munnerlyn’s formula, used for calculating the ablation in PRK, it shows a strong correlation between measured changes in refractive error and the refractive changes predicted.

Another prediction of the potential refractive change achievable was based on pre-fitting corneal shape. Since the early days of traditional OK, it has been noted that lens-induced central corneal flattening and mid-peripheral steepening together result in a change in overall corneal shape from the normal prolate (flattening) a sphere towards a more spherical shape. This principle has been used for patient selection in OK and, for example, Mountford (10) has proposed that potential refractive change (ΔRx; ΔD) can be estimated from baseline corneal eccentricity (e) using the formula ΔRx = e/0.21. Although these concepts have provided useful clinical rules-of-thumb, it is clear that corneal shape changes in OK are more complex than can be explained by changes in a single global corneal shape index. (11)

Advantages of Orthokeratology versus Refractive Surgery

The major advantage of orthokeratology compared to current refractive surgical techniques is its reversibility. Therapy can be halted at any time if unwanted effects are experienced.

It is also an option for children and may slow myopia progression. Myopia became an important health problem, mostly in Asian countries. Earl Smith’s studies have shown that optically imposed myopic defocus on retinal mid-periphery slows axial elongation. (12) As a result, in the past decade several trials have been made, including two randomized, to test the impact of OK on myopic children. It has been shown that orthokeratology reduce myopia progression by 30 to 50%, amounting to an estimated myopia progression control of 0.5 D per year in comparison to spectacle and soft contact lens wear. (13, 14, 15)

Disadvantages of orthokeratology

The correctable amount of refractive error is limited. Also OK is not a ‘permanent’ solution for myopia correction and the potential for non-compliance is similar to other types of contact lenses. Some of the patients may have RGP tolerance issues or contact lens complications.

Patient selection

The desirable patient features include spectacle prescription between -0.50 and -4.00 D SpH, with less than 1.50 D Cyl of corneal astigmatism. Higher correction is possible but outcome is less predictable. As topographic profile: central Kmax readings should be over 42.00D, preferably corneas that flatten in the periphery. Smaller pupil diameter is desirable. Previous contact lens wear, high motivation and realistic expectations are also important elements.

Contraindications

Diseases of the cornea, conjunctiva, or adnexa, for example keratoconus, severe cases of dry eye, inflammations and infections of the anterior segment are not to be fitted. Older patients and long-term CL wearers corneas may be also less likely to respond well. High cylinder, very steep or flat K values, spherical cornea (e ~0) may not be properly fitted. Deep-set eyes, very loose or flaccid lids, poor responder to initial lens wear trial may not achieve good vision. Systemic diseases that affect the eye or can be exacerbated by lens wear, e.g. diabetes, should be excluded.

Fitting process

A key factor in successful fitting of orthokeratology lenses is the use of a corneal topographer. The practitioner needs to master the interpretation of the images derived from this instrument and have an extensive knowledge of RGP lens fitting.

The topographer is essential for initial fitting. The instrument must be calibrated accurately and it is recommended that at least three and preferably six maps per eye be analyzed when calculating input data, encouraging the patient to blink fully.

Lenses can be ordered from some laboratories only by the Ks & Rx, from others by the topographical data and a lens-fitting software to suggests initial trial lens, or chosen using a specific calculator from an inventory of 100+ lenses.

The fitting pattern of the lens has to be examined at the slit lamp by use of fluoresceine. The ideal case presents 3 - 4.5 mm of central bearing, a wide, deep tear reservoir around central bearing zone with no or small air bubbles, good lateral centration, minimal movement with blink but with good tear exchange. Pupil coverage and total diameter are also to be assessed. The fit may be improved by varying the reverse curve radius, edge lift, total diameter or changing the design to a toric version.

The greatest reduction in myopic refractive error is usually achieved after the first night of OK lens wear and the endpoint of refractive change is reached after about seven to 10 nights of wear. There is slight regression of effect (about 0.25 to 0.75 D) during the day and lenses must be periodically worn overnight to retain the effect. Ideal orthokeratology end point is uncorrected VA of 6/6 or better, slight hyperopia up to 0.50D, regular corneal topography, bulls-eye pattern, minimal regression over 10 -12 hrs after lens removal and stable results over a 2 - 3 month period. It is unrealistic to expect 100% success rate. Deep set eyes or inaccurate topography may be the reason for the lack of success. Repeating the measurements and a new trial, eventually with alternative lens manufacturer or design may help. Lenticular astigmatism should be considered when predicting vision and purely lenticular cylinder can be quite problematic.

At each after-care examination should include history, subjective refraction, slit-lamp biomicroscopy, and corneal topography. Topography enables the practitioner to measure the corneal parameters and monitor accurately the effects of the lens on the cornea, to follow the progressive alteration in corneal shape with with the use of axial, tangential and refractive maps.

Figure no. 1. Axial, elevation, tangential and refractive map
Difference maps are helpful but the inspection of the absolute refractive and tangential maps, before and after treatment give the case a full understanding (figure no. 1).

There are several types of topography appearance that indicate a sub-optimal lens fitting and require a refit.

Central island (figure no. 2) indicates that the lens BOZR is not flat enough or an excessively tight mid-peripheral bearing.

**Figure no. 2. “Central island”**

"Smiley face" pattern indicates a superior decentration. Lens fitting may be too flat, total diameter too small or a corneal sag has been underestimated (figure no. 3).

**Figure no. 3. “Smiley Face”**

It is important to check also the lenses. They have to be properly cleaned in order to minimize the back surface deposits and replaced yearly.

**Figure no. 4. Infero-lateral decentration**

Corneal changes

Corneal staining occurs frequently on the central cornea within the first few weeks of wear, when it should be closely monitored, and reduces thereafter. It can be significantly influenced by rewetting drops. Corneal erosions may be attributed to excessive central bearing of the lens, trapped debris, or roughened lens surface, either from deposits on the back surface or from a manufacturing defect. Some cases presented incomplete ring or arc similar to Fleischer’s ring in keratoconus, adjacent to edge of treatment zone below tear pool, reversible in about 2-4 weeks.(16) Decentrations of the lens can induce corneal distortion. Hiraoka et al. showed that even in clinically successful orthokeratology, irregular corneal astigmatism was increased by the treatment and also the higher-order spherical aberrations.(17,18)

Infections

The safety of the procedure was a concern after cases of complications have been reported, in particular in regions where regulations are limited. As the reviews show, they were attributed to inadequately trained practitioners, lack of appropriate clinical equipment, the use of non-gas-permeable materials and tap water as contact lens solution. Where regulation and monitoring is optimum, the incidence of complications with OK lens wear has been reported to be similar to soft contact lens wear.(19) Nevertheless, working with children require extra measures to insure compliance and achieve contamination control.

**Conclusions:**

The development of advanced high Dk RGP lens designs and materials for the procedure has resulted in a better understanding of the orthokeratology process and has enabled the practitioner to employ a relatively predictable procedure based on corneal topography and other clinical observations and measurements.

Orthokeratology is a proven technique for managing the mild to moderate myope as an alternative correction to spectacles, contact lenses, and refractive surgery and has a certain effect of retarding myopia development in children.

**REFERENCES**

MYOPIA PROGRESSION CONTROL WITH ORTHOKERATOLOGY. CONTACT LENSES: ONE YEAR FOLLOW-UP

ANA-MARIA POP

Optilens Ophthalmology Clinic, Cluj-Napoca

Keywords: orthokeratology, progressive myopia

Abstract: Material and methods: I included in the study a group of 12 patients aged between 8 and 19 years old, with progressive myopia and/or family history of parental myopia, whom we adapted with orthokeratology contact lenses. The follow-up of the progression of myopia was evaluated by changing the anterior-posterior axis length, in the first year of contact lenses wearing. We assessed the progression of myopia over one year in a control group of similar age and history, glasses wearers. Results: The patients adapted with orthokeratology contact lenses obtained a slower progression of myopia compared to the year preceding contact lenses wearing and compared to the glasses wearers control group.

INTRODUCTION

How does orthokeratology control myopia progression?

The orthokeratology lenses actively influence the tear film profile through reversal design geometry, modifying the corneal surface topography and the refractive corneal power.

METHODS

First year follow-up: We selected 12 patients: females 10 (83.33%), males 2 (16.66%), aged: 8-19 years old (age average 12.4).

We assessed:

• Cycloplegic autorefractometry and spherical equivalent: -1.50 -4.75 (average -3.63)

• Corneal topography with Pentacam device

RESULTS

Average axial length one year before orthokeratology:

\[ n \ 0.25833 \text{ mm (0.7749 diopters)} \]

Average axial length after one year of orthokeratology:

\[ n \ 0.10875 \text{ mm (0.32625 diopters)} \]

Inclusion criteria for the second study (one year follow-up):

The orthokeratology group:

• 6 patients aged 8-13 years old

• Progressive myopia more than 0.50 diopters in the last year

• At least one first degree relative with myopia

The control group:

• 6 patients with the same features, glasses wearers

Table no. 1. The axial length before and after the orthokeratology treatment over one year

![Graph showing axial length before and after orthokeratology treatment.]

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RESULTS

Average myopia progression - Orthokeratology group:
- 0.5391 diopters (0.1797mm axial length)

Average myopia progression - Control group:
- 0.701 diopters (0.2336mm axial length)

CONCLUSIONS

On average, the evolution of myopia progression was somewhat slower in the orthokeratology group during the year of treatment compared to:
- the year preceding the contact lenses wearing
- the glasses wearers group

The results of this study are only partial, because of the short time of follow-up.

There is no prediction for a child regarding myopia control through the orthokeratology treatment, but all studies show very good statistical results for a group of children (Israeli Study-8 years-the longest up to date: myopia progression-Orthokeratology group -1.21 D, control group -4 D)

REFERENCES

Keywords: high myopia, choroidal neovascularization, fluorescein angiography (FA)

Abstract: Purpose: to describe the angiofluorographic characteristics of CNV that develop as a complication of pathologic myopia and were detected by FA. Method: the study of fluorescein angiograms of 89 patients with high myopia, who registered a recent decrease of VA accompanied by dysmorphopsia; the description of the CNV and associated lesions revealed by FA. Results: myopic CNV has a particular aspect, as it is often associated with predisposing factors like chorioretinal atrophic areas and lacquer cracks. Due to the predominantly sub- or juxtafoveal location, and to the extended retinal lesions associated with malignant myopia, the visual prognosis of these patients is poor.

INTRODUCTION
High myopia or pathologic (degenerative, malignant) myopia refers to eyes with a refractive error higher than -6 D, an axial length of more than 25.5-26 mm and with retinal degenerative changes and complications (biomechanical, neovascular and degenerative) in the posterior pole and/or in the fundus periphery.

These changes give the eye fundus a characteristic aspect (myopic fundus).

Figure no. 1. Clinical aspect of the fundus in high myopia

Table no. 1. Fundus aspect in high myopia

<table>
<thead>
<tr>
<th>Lesions found in the posterior pole:</th>
<th>Lesions found in the fundus periphery:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optic disc crescent (temporal, annular)</td>
<td>Lattice degeneration</td>
</tr>
<tr>
<td>Tilted optic disc, vasculature “situs inversus”</td>
<td>Pigmentary degeneration</td>
</tr>
<tr>
<td>Vascular straightening</td>
<td>White without pressure</td>
</tr>
<tr>
<td>Thessellated fundus appearance (increased visibility of the choroidal vasculature)</td>
<td>Paving-stone degeneration</td>
</tr>
<tr>
<td>Posterior staphylooma</td>
<td>Retinal breaks (holes)</td>
</tr>
<tr>
<td>Lacquer cracks (ruptures in the RPE-Bruch’s membrane-Choriocapillaris Complex)</td>
<td>Retinal detachment</td>
</tr>
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Choroidal neovascularisation (CNV) is the most vision threatening complication, occurring in 5-10% of eyes with high myopia. 30% of these patients will develop CNV in the second eye within the next 8 years.

CNV determines the following acute symptoms: decrease in visual acuity, metamorphopsia, central or paracentral scotoma. On clinical examination, a greyish, flat, small lesion is noticed, situated usually sub- or parafoveally.

The evolution of CNV associated with myopia without treatment is not very favourable and poor prognostic factors are large CNV, severely decreased visual acuity and age over 40. It is very important to diagnose a CNV, as its evolution can be influenced with anti VEGF treatment.

METHODS
We performed 89 fluorescein angiograms in myopic patients with different degenerative chorioretinal changes, who reported a recent decrease in visual acuity.

The mean age of our patients was 51 years old (63 females with a mean age of 49 years old and 26 males with a mean age of 56 years old).

We selected the cases in which a CNV was detected and we described its aspect and that of the associated lesions.

In most cases, the angiogram revealed a classic, well defined CNV, sometimes with a hypofluorescent halo, small in size (less than 1 optic disc diameter), situated sub- or juxtafoveally, presenting minor to moderate exudation in the late phases.
Sometimes, a larger CNV is revealed and in this case the prognosis is poor.

It is rare for choroidal neovascular membranes in myopic eyes to have a poorly defined aspect, but these findings have been described.

The evolution of CNV is towards scaring and the aspect of cicatricial CNV on the angiogram presents hyperfluorescence due to staining, but no exudation.

It is often that CNV in myopic eyes to be associated with chorioretinal atrophy or with ruptures of Bruch’s membrane (laquer cracks).

As for the location of the membrane, it was subfoveal in 89% of cases (48 eyes), juxtapfoveal in 21% (13 eyes), extrafoveal in 6.5% (4 eyes) and parapapillar in 3.2% (2 eyes).

In our study, 53 (~60% of cases) out of the 89 angiograms performed in high myopic patients have revealed the presence of a neovascular membrane, and 8 cases presented bilateral CNV. That makes a total of 61 eyes with CNV. It is worth mentioning that we registered a definitely larger group of female patients. Of the 53 patients with CNV, 38 were women (mean age 52) and 15 were men (mean age 57)

Considering the aspect of the membrane, it was classic in 62% of cases (38 eyes), cicatricial in 20% of cases (12 eyes) and poorly defined in 18% of cases (11 eyes).
The associated predisposing lesions found were lacquer cracks in 27 cases (44%), chorioretinal atrophy in 21 cases (35%) and RPE changes in 10 cases (25%).

CONCLUSIONS
In conclusion, CNV represents a major complication of the degenerative lesions in myopia, having an important impact on visual acuity. It seems that women are more often affected and our study confirmed that observation (71% of cases). This may raise the hypothesis that estrogen may play a role in the mechanism of the development of CNV.

The age at which these membranes appear is generally after 50. In our group, the mean age was 53 with only 36% of patients under 50 years of age.

The majority of myopic neovascular membranes are small, classic, subfoveal and respond to anti-VEGF therapy.

Reviewed articles state that approximately 30% of myopic patients with CNV will develop CNV in the second eye within 8 years. In our study, 15% of cases were bilateral. Although predisposing lesions for CNV (lacquer cracks, chorioretinal atrophy, RPE changes) are well known and easily detected; no prophylactic treatment can be applied. A correct assessment of all fundus changes is necessary before any surgical intervention whether refractive or cataract surgery, in order to evaluate the visual prognosis.

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NEW THERAPIES FOR MYOPIC CHOROIDAL NEOVASCULARIZATION

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Keywords: myopic choroidal neovascularization aflibercept tachyphylaxis

Abstract: This article presents a clinical observation on two cases of high myopia associated with choroidal neovascular membrane, treated with EYLEA (aflibercept). The purpose of this study was to evaluate aflibercept’s effect on the choroidal neovascular membrane. The method consisted in evaluating the following parameters: visual acuity, presence/absence of metamorphopsias, ophthalmoscopic aspect, OCT aspect both, before and after aflibercept intravitreal aflibercept injection treatment (1 injection). Results were positive, showing clinical and anatomical improvement.

INTRODUCTION

The Myopic Choroidal Vascularisation

High myopia is one of the leading causes of blindness around the world. It is characterized by retinal degeneration, both peripherally and centrally.

The complications that appear at the macula’s level are numerous and polymorphic, inevitably leading to impaired visual acuity, and can be categorized into three entities of myopic maculopathy: atrophic, tractional (foveoschisis and macular hole), and neovascular.

The presence of posterior staphyloma is involved in the etiopathogenesis of these changes.

Pathological myopia is the leading cause of choroidal neovascularisation in young patients.

Myopic choroidal neovascularisation’s morphological characteristics differ from the old age – related macular degenerescence.

Most of the times, it is a small, round lesion, pigmentedly outlined or entirely pigmented, subfoveally located or very close to the fovea. It can be found at the border of scleral staphyloma; it shows recurrent hemorrhages, being at the origin of the Foerster-Fuchs spot, a wide degenerative lesion with fibrotic centre, surrounded by atrophy.

The usual diagnosis tests are the fluorescein angiography or the indocyanine green angiography, and the optical coherence tomography (OCT).

Aflibercept (Eylea)

Aflibercept is a vascular growth factor inhibitor, destined to block the growth of neovessels and to decrease vascular permeability through blocking the vascular endothelial growth factor (VEGF-A) along with the placental growth factor (PIGF).

It has been the last approved anti VEGF in the USA and EU for treating the following clinical entities: age related macular degenerescence in its neovascular form (USA 2011, EU 2012), macular edema following central retinal vein occlusion (USA 2012, EU 2013), diabetic macular edema (USA and EU 2014).

Recently, (in September 2014) aflibercept has been approved in Japan for treating myopic choroidal neovascularisation, the approval being based on positive data from the third phase of the MYRROR study.

This study concluded that patients receiving Eylea had a visual acuity improvement of 12.1 letters after 24 weeks, compared to a loss of 2 letters in patients from the control group.

Japan Approves Bayer’s Eylea for Myopic Choroidal Neovascularization

Mon, 09/22/2014 - 9:58am

The approval is based on positive data from the Phase 3 MYRROR study in myopic CNV. The top-line results, where patients receiving Eylea had a mean improvement in best-corrected visual acuity (BCVA) from baseline at week 24 of 12.1 letters, compared to a loss of two letters in patients receiving sham injections ( p<0.0001), were announced at the American Academy of Ophthalmology Congress in New Orleans.

CASE REPORT

Since August 2013 till October 2014, at the OPTILENS Clinic in Cluj-Napoca, there were 35 patients treated with aflibercept (35 eyes, 79 injections).

This intravitreal injectable treatment has been recommended for treating the age related macular degenerescence in its neovascular form, the diabetic macular edema or macular edema following vein occlusions, the chronic central serous chorioretinopathy, and the idiopathic or myopic choroidal neovascularization (2 cases).

The first case is that of a 50-year old woman, diagnosed in 2011 with:

RE: Myopic choroidal neovascularization.
BE: High myopia.

The angiographic aspect in 2011 was as follows (figure no. 1).

During 2011–2013, she underwent 20 intravitreal Bevacizumab injections. The initial evolution was good, with the inactivation of the neovascular membrane, yet with recurrences. After the 16th injection, the results were null, and tachyphylaxis occurred.
In August 2013, the clinical status was as follows: VRE = 0.1 with correction, central scotoma and positive at Amsler test, IOP RE = 16mmHg.

The OCT aspect (figure no. 2) shows a hyperreflective formation that deforms the pigmentary epithelium precisely in the foveolar region, and also a retinal cyst and serous neuroretinal detachment.

I decided to administer aflibercept intravitreal injections; there was good tolerance, with no incidents or side effects, and one month after the injection, the clinical status had improved: VRE = 0.3 with correction, negative at Amsler test, and a much improved OCT aspect, with the complete disappearance of the serous neuroretinal detachment, and also cyst and hyperreflective formation shrinking (figure no. 3).

In December 2013, a recurrence occurs, with decreased visual acuity (VRE = 0.2) and serous neuroretinal detachment again (figure no. 4). I performed the second injection, but the patient never came back for check-up.

The second case was that of a 51-year old woman, being diagnosed in July 2014 with:

- BE: High myopia.
- LE: Myopic choroidal neovascularisation.

Visual acuity at LE was: VLE = 0.3 cc, positive at Amsler test, IOP RE = 16 mmHg.

The initial angiographic and OCT aspect was as follows: (figures no. 5 and 6).

I performed one Aflibercept intravitreal injection, and at the one month check-up, the clinical status was much improved (VRE = 0.6 cc, negative at Amsler test), and the OCT aspect slightly modified (figure no. 6) (seeming restriction of the hyperreflective juxtafoveal formation).

In absence of the serous neuroretinal detachment that had been seen prior to the injection during the OCT examination, a follow-up through this investigation proved to be more difficult, so I considered that the clinical aspect should prevail.

Both the clinical status and the OCT aspect were stable at 2 and 4 months after the injection, presenting visual acuity preservation, the absence of metamorphopsias, and unchanged OCT aspect.

**RESULTS AND DISCUSSIONS**

After the Aflibercept treatment, both patients presented improved visual acuity and OCT aspect. None of the patients suffered side effects, the medicine being well tolerated. There was no reported incidence related to the injecting manoeuvre. Case number 1 presented a complete fluids resorption after the first injection, despite the tachyphylaxis after
Bevacizumab. However, four months after the injection, recurrence occurred.

In case number 2, the evaluation after injection mainly considered the clinical status, due to the fact that the OCT aspect had not been very relevant. Unfortunately the follow up in both cases was of short duration.

CONCLUSIONS

Aflibercept seems to be a good choice for cases already suffering from tachyphylaxia due to other VEGF inhibitors.

The effect of Aflibercept injections in patients having myopic neovascularisation seems to be good, both clinically and morphologically. The positive result and the absence of side effects open new perspectives in treating the myopic choroidal neovascularisation.

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CORNEA EVOLUTION AFTER ACCIDENTAL ENDOTHELIOPIRHEXIS

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Keywords: accidental endotheliorhexis, corneal endothelial functional reserve

Abstract: We present the case of a patient who accidentally underwent a descemetorhexis, followed by loss of endothelial corneal flap. Postoperative evolution may be subject to complex discussions, since it is beyond any medical supposition.

INTRODUCTION

Improved visual acuity and corneal clearing have been observed in a series of cases, involving different pathologies and therapeutic attitudes, without currently understanding their exact mechanisms. In this context, we present our case, with its lesion and evolutionary features.

CASE REPORT

A 68-year-old female patient was diagnosed OU: cortico-nuclear cataract, OD – mature, OS – evolving.

BCVA OD: h.m., BCVA OS: ¼, normal IOPs.

She was advised of cataract surgery by phacoemulsification and PC IOL implantation.

Phacoemulsification is a therapeutic action, which also involves teaching issues. In this particular case, a resident started the operation.

An unpredictable situation regarding the control of the operator microscope led to one of the exceptional incidents of phacoemulsification. Instead of capsulorhexis, it was achieved accidental endotheliorhexis, followed by loss of the endothelial flap. The intervention was continued by real capsulorhexis, phacoemulsification and IOL implantation.

Second day postoperatively, when removing the ocular dressing: epithelialised, clear cornea, central edema, normotonic globe, VA OD=c.f. at 2m (slightly higher than VA OD at the admission=h.m.).

Treatment: Maxitrol 1 drop x6/day, Vigamox 1 drop x4/day (7 days), Indocolyn 1 drop x4/day.

7 days postoperatively: OD: clear cornea, central edema, VA OD=1/20, calm patient, optimistic about the evolution of the visual acuity in OD.

30 days postoperatively: VOD=1/10, clear cornea, CCT=620 microns, continues Maxitrol 1 drop x2/day, Indocolyn 1 drop x4/day.

60 days postoperative: OD: clear cornea, CCT=600 microns, VA OD=2/10, optimistic patient, stupefied doctor! A specular microscopy in the OD was performed (figure no. 1).

Specular microscopy shows endothelial cell density (CD)=948/mm², variation coefficient (CV)=44, which means polymegathism, and endothelial cells lose their hexagonal shape (HEX=0), becoming pleomorphic.

After this period, the patient never attended any control (being satisfied with her visual acuity).

DISCUSSIONS

Given the evolution of this case, we acknowledge stupor. How was it possible that a situation which we considered to be a dramatic accident would follow a course beyond our most optimistic forecasts?

Corneal transparency is ensured by the corneal endothelium functioning within normal parameters, through its dual barrier-pump role. Classically, it is accepted that endothelial cells do not support mitoses, hence the importance of their protection.

How was it possible for the loss of a 5mm diameter endothelial flap to be functionally compensated?
Figure no. 2. Mathematical calculation

\[ A_{\text{total}} = \pi R^2 = 144\pi, \quad R = 12\text{ mm} \]
\[ A_{\text{rhexis}} = \pi r^2 = 25\pi, \quad r = 5\text{ mm} \]
\[ A_{\text{residual}} = A_{\text{total}} - A_{\text{rhexis}} = 119\pi \]
\[ \frac{A_{\text{residual}}}{A_{\text{total}}} = \frac{119\pi}{144\pi} = 0.8 \]

+80% endothelial cells for a 5 mm rhexis = 1.600 cel/mm²
+75% endothelial cells for a 6 mm rhexis = 1.500 cel/mm²

A simple mathematical calculation, considering the large radius of the cornea 12 mm and the small radius of the rhexis 5 mm shows that 80% of the total area of the corneal endothelium represents the area of the endothelium remained after rhexis. 80% of a 2000 cel/mm² average endothelial cell density for her age gives a 1600 cel/mm² endothelial cell density remained after rhexis. Similarly, according to a 6 mm rhexis, we obtain an endothelial cell density of 1500 cel/mm² (figure no. 2).

We did not consider the lost endothelial cells from the remaining endothelium, after the surgical trauma. The fact is that residual endothelial cells were able to ensure corneal transparency, until a given time (60 days postoperatively). Unfortunately, we do not know what would have happened after.

The dilemma remains: corneal transparency was due to migration of the remaining endothelial cells or endothelial mitoses were possible? (2,3)

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ASSOCIATION OF SEVERE MYOPIA WITH OPEN-ANGLE GLAUCOMA. A CORRUPT AND FATED COUPLE

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Keywords: myopia, glaucoma, myopic glaucoma

Abstract: Myopia association with open-angle glaucoma is a common statistical finding, but the relationship between the two entities involves many aspects still questionable. Myopia can induce structural changes that may make it difficult to distinguish glaucomatous optic neuropathy from myopia-related optic nerve and retinal abnormalities. Their functional implications are sometimes difficult to distinguish from those of POAG. Imaging methods (OCT) may not distinguish structural modifications induced by myopia from those induced by the POAG, reducing the accuracy of these methods in association between myopia and glaucoma. Visual field in high myopia has a few special characteristics; lower sensitivity threshold stimulus, and structural changes of papilla that can simulate false glaucomatous progression. This has the particularity that they may improve after the correction of myopia. The interference of the two conditions makes it difficult for both, diagnosis and monitoring of disease progression. It is a worrying and dilemmatic situation commonly seen when a subject with high myopia has an optical disk with structural changes suggesting a glaucoma, borderline changes of VF and normal or slightly elevated and fluctuations IOP values. The association between myopia and glaucoma has the allure of a perfect couple in which the two members loses their identity as a result of mutual corruption In this association, glaucoma is hiding after myopia and takes advantage of its vulnerability and myopia is a risk factor for open-angle glaucoma that may complicate both the diagnosis and treatment of glaucomatous disease. In association of severe myopia with glaucoma, there is a range of clinical and genetic interference. The existence of this interference makes it difficult the clinical identification of the profile of each of the two diseases and could be taken into consideration when changing the paradigm of this morbid association. What do you think if instead of severe myopia with POAG association to use the term of primary myopia or myopic glaucoma?

Myopia affects approximately 1.6 billion people worldwide and has a growing prevalence in some areas.(1,2,3) High Myopia (HM = myopia over-6 d) is of 27-33% of them and in addition to changes of ocular refraction, HM is characterized by progressive degenerative changes of the fundus, such as ocular axial elongation, optic disc deformation, retinal thinning and choroidal atrophy.

The association of the open-angle glaucoma with medium and large myopia is a frequent clinical finding and conclusion of extensive statistical studies (the Blue Mountains Eye Study (4) and Beijing Eye Study (5), which found a relationship in direct proportion to the prevalence of glaucoma with myopia.

A meta-analysis of 11 studies conducted between 1994 and 2010, which amounted to a total of 48,161 individuals (6) concluded that myopias with values of over-6 D increases the risk of glaucoma.

The criteria used for the diagnosis of glaucoma in these studies vary what is questionable about their accuracy to distinguish some structural changes induced by glaucoma from those induced by myopia.

Patients with severe myopia have a higher probability of developing ocular hypertension, open-angle glaucoma or normal tension glaucoma, compared with those with emmetropia.(7) The association of glaucoma with myopia beyond statistical records appears to be a morbid complex association with a related pathogenesis, two theories supporting the pathogenesis of the two disorders.

1. Genetic theory
Tang et al. (8) have noted the presence of genetic polymorphism of Myocilin among patients with high myopia in Chinese families. They found that the genetic polymorphism of Myocilin was associated with both myopia and with open-angle glaucoma, suggesting a connection of the two diseases through this gene.

This gene could explain the high IOP response to corticosteroids in high myopia eyes.

Patients with severe myopia or open-angle glaucoma are much more sensitive (as hypertensive reaction) to corticosteroids compared to normal subjects.

Armaly and Becker (9) have found that 90% of patients with POAG respond to corticosteroids compared to 4-5,5% of normal subjects.

Gentle et al. (10) noticed that 88% of those with severe myopia but with normal have a high IOP response to corticosteroids, 29% of those with IOP values of over 31mmHg.

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2. Collagen changes theory

Curtin and Karlin studied posterior sclera of the eyes with severe myopia by electronic microscopy, and found changes in its structure. These changes might induce an increase in plasticity collagen fibers and a reduction in their cross-linking which would make them more deformable and more vulnerable to IOP.

Severe myopia is today regarded as a disease with autosomal dominant, autosomal recessive or X-related genetic determinism.

Severe myopia has its own structural changes.(11,12)

The optic disc appears pale, and may be surrounded by an arc-shaped degenerative region with choroidal atrophy, the optic cup being relatively shallow.

The posterior pole is atrophic or depigmented, and the retinal nerve fibre layer (RNFL) may be thinned without the normal arched path of the retinal nerve fibre bundles.

The parapapillary area is one of the most vulnerable zone of the eyes with severe myopia. As if the suffering of ganglion cells in POAG is not enough, the ganglion cells axons in myopic eyes run across this desert and the austere parapapillary area, where the scleral tissue is thin and fragile, where the scleral tissue biomechanics is changed. Lack of choroid in this area deprives lamina cribrosa of nutrient vessels and lack of Bruch membrane makes the retino-choroidal stability to be affected.(13)

In high myopias, swept source - OCT examination shows far more serious structural changes at the level of the subarachnoid space with its extension in the perioptic area.(14,15,16)

The face of glaucoma in myopic eye

Diagnosis of glaucomatous optic neuropathy involves structural changes in dynamics and functional changes in relation to them.

Structural changes that define glaucoma are those of the papilla and RNFL.

The optic disc is surrounded by an arc-shaped degenerative region with choroidal atrophy.

The optic disc appears pale and is oval, oblique and deformed. The optic cup varies in morphology, being eccentric and usually downward.

Diffused RNFL atrophy, which is closely related to the visual field defects, occurs primarily in the inferior retina. Stereoo photo FO monitored over time can be a precise method of assessing the progression of the disease.

The current SD-OCT devices in spite of the progress made have limited accuracy in detecting typical structural changes of glaucoma and assessing structural progression in patients with severe myopia.(17,18,19) Due to increased ocular axis that induces an increase in the image magnification (devices do not have a programme to link the image with the sagittal axis of the eye), these devices may induce false positive errors.

These devices do not have in their databases myopias without severe glaucoma as reference data. In addition to the absence of reference data including myopic eye, myopic eye peculiarities request that OCT-SD devices to be used with special attention in these cases.(20,21,22)

The first measurements will constitute the reference of the patient and the subsequent ones will monitor the dynamics of structural change. Seemingly simple but if we take into account the variability of the data from one measurement to another, in normal eyes we can notice the limits of these devices. The OCT-SD studies in the diagnosis of glaucoma in the initial phases have noted great variability of measurements. Global parameters were the most sensitive and specific in these cases.(22,23)

There are studies that have found a correlation of papilla ovalisation with both the degree of short-sightedness and modification index MD of CV.(23,24) Atrophy of beta parapapillary area corresponds to lack of Brush membranes and correlates with the degree of myopia and with changes of MD index of VF.

With these structural and functional interferences of myopia with glaucoma, can we begin glaucoma treatment based only on early changes of VF?

Visual field examination in patients with severe myopia has to distinguish between the changes induced by the glaucoma and those induced by myopia.

In myopia, VF changes induced by parapapillary atrophy, tilted papilla or myopic maculopathy can lead to confusion with those present in early glaucoma.

It is a worrying and dilemmatic situation of young myopic with cupping disc (C/D over 60%), beta parapapillary atrophies, tilted disc, changes of VF close to those of early glaucoma and a TIO around the upper limit of normal range.

There are studies that have found a correlation of papilla ovalisation with both the degree of myopia and modification index MD of VF. Atrophy of beta parapapillary area corresponds to lack of Brush membranes and correlates with the degree of myopia, with changes MD index of VF, but it may be the source of the VF error.

How do we identify glaucoma in this gray area interference? How do we treat and how do you follow?

One of the edifying factors is the progression of the disease. Myopia progressing up to 23-24 years as refraction, but degenerative changes may continue throughout his life. Glaucoma progresses at any age.

There are studies (25,26) which noticed that. In myopia greater -8 D without glaucoma associated, progressive changes can occur in VF in about 13% of cases after a period of 5 years and in approximately 74% after 10 years. These changes did not have the appearance of those encountered in glaucoma and the common feature of these optical eye was the oval papilla.

Changes of the VF in myopia and glaucoma.

In myopia, VF changes do not observe the horizontal meridian while those of glaucoma observe it. In myopia, VF enhancements can be noticed after a better optical correction.

When you begin glaucoma treatment?

When we found the progression, when changes in VF are suggestive for glaucoma, there is a hereditary of glaucoma, when VF is severely affected and threatened fixation.

Is glaucoma treatment efficient?

Can we use the surrogate parameter target pressure in those circumstances? IOP values are relative low in eyes with severe myopia and their measurement may be inaccurate due to the errors induced by corneal thickness, corneal hysteresis or the existence of prior corneal refractive surgery.

On the other hand, there is a decreased tolerance of retinal ganglion cells to IOP values around the upper limit of the normal range.

These data could be an argument for target pressure values as small. We can follow this reasoning to surgical treatment. Filter operations can lead to the scleral wall collapse and hypotonic maculopathy.

The association with glaucoma myopia has the allure of a corrupted couple, a couple in which each of the partners corrupts the other by altering its identity. Severe myopia, by its own structural changes, may induce false positive errors in OCT-SD and by the relatively low IOP values, it may induce false-negative errors in IOP appreciation, as real risk factor.
Glucoma occurring in a myopic eye is more aggressive, tolerates less amounts of IOP and less amount of IOP fluctuations. It is a corrupt and fated couple: fated to sum weaknesses of partners, fated to decline, fated to unfavorable vulnerability, fated to diagnostic and therapeutic dilemmas. It is a couple in which its partners sum up their vulnerabilities and borrow each other’s appearances, an almost incestuous couple with genetic analogies.

We do not know whether there would be more appropriate as instead of combining the two entities (myopia and glaucoma), to consider this morbid association as an individual entity; primary myopia or myopic glaucoma.

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CORRECTION OF MYOPIA AND MYOPIC ASTIGMATISM WITH GLASSES

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Keywords: accommodation, monocular diplopia, refractive errors

Abstract: The accommodation provides a mechanism of focusing at different distances. The optical changes in cataractous lens are the following: visual acuity reduction, myopic shift, monocular diplopia, glare and colour shift. Refraction is the change in light direction when passing from a medium to another medium, with different refractive index. There are two types of ocular refraction: static refraction and dynamic refraction (accommodation).

The ocular diopter is made up by cornea, anterior chamber, lens and vitreous.

The cornea participates in the ocular refraction through its curvature and through its significant difference in refractive indices of air and cornea. The vertical diameter is slightly smaller than the horizontal one. The front apical radius is 7.7 mm K (48.83 D) and the back apical radius is 6.8 mm K (-5.88 D). The actual refractive index of the cornea is 1.376. The power of the cornea is +43D (2/3 of total eye power). It is not optically homogenous (ground substance)=1.354, n (collagen)=1.47.

The anterior chamber (AC) is the cavity between cornea and iris, filled with aqueous humor. The depth of AC is about 2.5-4.0 mm. Change in AC depth leads to total power change, thus 1 mm forward shift of lens increases about 1.4D in power. The refractive index of aqueous humor is 1.336.

The iris and the pupil regulate the amount of light entering the eye. At 2.4 mm pupil size, the best retinal image is obtained, as aberration and diffraction are balanced. The average size of the pupil is 2-4 mm. The depth of focus increases as the pupil size decreases. This concept is used in refraction as the pinhole test. The retinal image quality improves and the size of the blue circle increases as the pupil enlarges.

The crystalline lens thickness at birth is 3.5-4 mm and in the adult life, 4.75-5 mm. Its radius of curvature of the anterior surface is 10 mm and the one of the posterior surface is 6 mm. The refractive index of the lens nucleus is 1.41, the one of the pole is 1.385 and at the equator is 1.375. The total power of the crystalline lens is 15-18D. The accommodative power at birth is 14-16D, at 25yrs is 7-8D and at 50yrs is 1-2D. Lens accounts for about one third of the refraction of the eye.

Myopia is a form of refractive error in which parallel rays of light entering the eye are focused in front of retina with accommodation being at rest (figure no. 1).

Figure no. 1. Myopia

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The etiological types of myopia are: axial (MC - increased AP length of eyeball), curvational (increased curvature of cornea, lens or both), index (increased refractive index of lens with nuclear sclerosis), positional (anterior placement of lens) and myopia due to excessive accommodation. The clinical types of myopia are: congenital, simple or developmental, degenerative or pathological, acquired. Congenital myopia is common in premature babies or with birth defects; it is stationary (8-10D) and is associated with increase in axial length, esotropia, other congenital anomalies of eye, early and full correction under cycloplegia. The prognosis is poor in unilateral cases with severe myopia and anisometropia.

Simple myopia is physiological (also named school myopia). It is the commonest type and results due to normal biological variations in development of eye. The age of onset is 7-10yrs, it has moderate severity (<-5D, never exceeds 8D) and no degenerative changes.(5,6)

Degenerative myopia is progressive in nature, related to heredity, general growth process, heredity linked growth of retina, factors affecting general growth process. The age of onset is the early adult life and it is severe > -6D. The clinical features are: distant blurred vision, half shutting of eyes, asthenopic symptoms, muscae volitantes, night blindness and divergent squint. The signs are: prominent eyeballs, large cornea, anterior chamber is deep, large & sluggishly reacting pupil, fundus examination (changes seen only in pathological myopia: myopic crescent, Foster – Fuchs’s spots, posterior staphyloma).

In the myopic eye accommodation the punctum proximum (PP) is localized nearer the eye, compared with the emmetropic eye and the punctum remotum (PR) is localized between the eye and the infinity. The accommodative amplitude is smaller and the accommodation range is smaller than the one of emmetropic eye.

These patients develop presbyopia later. The optical treatment is with concave lenses or contact lenses (divergent lenses) (figure no. 2).

**Figure no. 2. Optical treatment – divergent lens**

The lens’ optical aberrations are: spherical aberrations, chromatic aberrations, oblique aberrations and coma. Spherical aberrations appear because a convex spherical lens refracts peripheral rays more strongly than paraxial rays, so peripheral rays are focused closer (figure no. 3).

**Figure no. 3. Spherical aberration**

Chromatic aberrations appear because different colour rays have different focal length, as refractive indices of media vary with the wavelength of the incident light. Oblique aberrations appear when the object is in peripheral visual field, a thin incident narrow pencil of rays enter limited by the pupil. Peripheral portion of lens forms Sturm’s conoid, so two line foci are formed. This is reduced to minimum in human lens due to curvature of retina, but is significant in biconvex/biconcave lens. Coma forms because different areas of lens form foci in planes other than chief focus, producing a coma effect in image plane, from a point source of light.(7,8)

**Guidelines for optical correction of myopia:**

- In children < 8 years of age, the correction concordant with the grade of myopia and the correction of astigmatism is mandatory.
- Permanent wear of glasses is mandatory (development of accommodation).
- The correction is made after cycloplegia (very important; sometimes atropine is necessary). Avoid overcorrection, except in controlling an exodeviation.
- Parents should be educated about the natural progression of myopia and the need for frequent refractions and possible prescription changes, even at 6 months.
- Contact lenses may be desirable in older children to avoid the problem of image minimizing found with high minus lenses.
- In adults < 30 years old, full correction is obtained. In adults > 30 years old, sub correction is opted for, choosing the one with which patient is comfortable for near vision.
- In case of presbyopia, the correction at distance is the correction of myopia and at near the correction is made with divergent lenses of low diopters, concordant with age or convex lenses.
- In high myopia, subcorrection is done to avoid near vision problem and minification of images. Contact lenses are better (to avoid image minimization).(9)

**Astigmatism**

Astigmatism is a defect of the optical system causing light rays from a point source to fail to meet in a focal point resulting in a blurred and imperfect image.

The Conus of Sturm is a geometric configuration of light rays emanating from single point source & refracted by spherocylindrical lens. The focal interval of Sturm is the distance between two focal lines. The circle of least diffusion is where the best overall focus is obtained. At the dioptric mean of focal lines the cross section of sturms conoid appears as circular patch of light rays.

The types of astigmatism are: regular astigmatism (the change in refractive power is uniform from one meridian to another): with-the-rule astigmatism, against-the-rule astigmatism, oblique astigmatism, bi-oblique astigmatism; and irregular astigmatism (irregular change of refractive power in different meridians).

The types of regular astigmatism are: simple astigmatism (simple hyperopic astigmatism and simple myopic astigmatism), compound astigmatism (compound hyperopic astigmatism and compound myopic astigmatism) and mixed astigmatism.

The regular astigmatism is correctable by spherocylindrical lenses. The etiology factors are: corneal (abnormalities of curvature – common), lenticular, which is rare and can be curvational (abnormalities of curvature of lens as seen in lenticuous) and positional (tilting or oblique placement of
lens, subluxation) and retinal, which is rare (oblique placement of macula).

The symptoms are: blurring of vision, asthenopic symptoms, tilting of head and squinting (half closure of eyelid).

The investigations required are: retinoscopy, keratometry, computerized corneal tomography, astigmatic fan test, Jackson cross cylinder.(10,11)

**Guidelines for optical treatment:**

In case of small astigmatism, treatment is required in presence of asthenopic symptoms or decreased vision.

In case of high astigmatism, full correction is preferred. It is better to avoid new astigmatic correction in adults because of intolerable distraction. Bi-oblique, mixed, high astigmatism are better treated by contact lenses. Correction of spherical component is made also.

The types of lenses used are: cylindrical lenses, which are orientated with their inactive axis perpendicular on the astigmatic meridian and are indicated in simple myopic astigmatism, or spherical cylindrical lenses. The spherical component is used to correct the less ametropic meridian → simple astigmatism corrected afterwards with cylindrical component. This lenses are indicated in compound myopic astigmatism.(12,13)

The correction of astigmatism with presbyopia at distance is full and at near is full plus spherical correction concordant with the age.

Anisometropia is the difference in refractive power between 2 eyes.

Refractive correction often leads to different image sizes on the 2 retinas (aniseikonia). Aniseikonia depends on the degree of refractive anomaly and the type of correction. Closer to the site of refraction delicit the correction is made → less retinal image changes in size.

Glasses magnifies or minifies 2% per 1 D. Contact lenses change less than glasses, The tolerable aniseikonia is ~ 5-8%.(15). Usually, it is congenital and often asymptomatic.

The treatment for anisometropia > 4 D is the correction with contact lens and for unilateral aphakia, contact lens or intraocular lens.(16)

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FITTING SOFT CONTACT LENSES IN CHILDREN WITH MYOPIA

DANIELA GOICEA

Abstract

Children may have even greater need of contact lenses than adults, as they are more active and more sensitive about their self-image. Experience shows that starting from low ages (6-8 years old), they are capable of wearing contact lenses. Studies show that soft or rigid monofocal contact lenses do not influence progression of myopia (Horner, 1999; Walline, 2008; Katz, 2003; Walline, 2004). Among the methods tested for myopia control, only orthokeratology and distance-center soft bifocal or multifocal lenses indicated a reduction in myopia progression by 50% (Aller, 2006; Sankaridurg, 2011; Walline, 2013). In the case of soft bifocal lenses, the mechanism behind the reduction of myopia progression is not merely the diminished accommodation effort. More important is that they create a ring of myopic peripheral defocus decoded as a "stop" signal for eye growth. If they wish correction of vision with contact lenses, children should chose multifocal or ortho-k lenses, which in addition to good vision contribute to the reduction of myopia progression. Contact lenses should be used as long as the risk for myopia progression lasts, both for kids as well as for youth.

Keywords: reduction of myopia progression, soft multifocal contact lenses, orthokeratology lenses

Myopia is a topical subject today due to its increasing prevalence and increased values, as well as due to the availability of methods for preventing its progression. Wariness induced by myopia is related to its increased prevalence – for example in the USA from 25% to 42% in only 30 years for 12-54 years old population, as well as to higher myopia (1), being known that myopia represents a risk factor “depending on dose” for serious ocular affections as glaucoma (2), retinal detachment (3) and cataract.(4) For example, the risk of retina detachment is 4 times higher in patients with small myopia compared with non-myopic ones, and 10 times higher in patients with medium or high myopia.(3)

Causes of myopia

Recent studies on animals show that hyperopic defocusing acts as a strong stimulus for eye growth, which accompanies the appearance of myopia. In addition, Smith demonstrated that peripheral retina may influence eye growth more than macula.(5)

Wearing concave lens spectacles brings the image in fovea, but enhances peripheral hyperopic defocusing, favoring higher myopia. According to this theory, we could prevent the increase of myopia with lenses which determine peripheral myopic defocusing.

The importance of accommodation in the appearance of myopia has been under discussion for a long time. Lundstrom connects the roles of peripheral defocusing and accommodation, demonstrating that the emmetropes have a higher peripheral myopic defocusing during accommodation than myopes. If peripheral myopia prevents progression of myopia, then this accommodative phenomenon can explain emmetropization.(6)

Studies on myopia control

Many methods have been tested in the attempt to reduce myopia progression. Some of them proved to be efficient, others having even adverse effects. Thus, undercorrection of myopia (7,8) and the use of gas permeable contact lenses (9,10) showed to favor the increase of myopia compared to total correction by spectacles. Bifocal and multifocal spectacles recorded an average efficacy of 18% (11), whilst spectacles designed especially for myopia control, which induce peripheral myopic defocusing, reduced myopia progression by 30%. (12) The most efficient method to reduce progression of myopia, of 81% (11), seems to be the use of atropine. However, its use is limited due to adverse effects (photophobia, the need for near spectacles). Recently it was found that using low concentrated atropine (0.01%) has similar results and reduced adverse effects (13), but it is not on the market yet. An efficacy of approx. 50% (11) have been proved for soft bifocal or distance-center multifocal (DCMF) contact lenses (CL) and orthokeratology (ortho-k) lenses, which are available and relatively easy to use.

Studies on the efficacy of soft bifocal or multifocal contact lenses

The first to notice the efficacy of bifocal CL in reducing myopia progression was Aller, who published a retrospective study after using such CL for improving compliance in bifocal or multifocal spectacles.(14) Subsequently a prospective randomized study in children with myopia and esophoria was conducted, which showed a reduction by 87% of myopia progression in this group compared with a similar group with monofocal CL.(15)

After discovering the role of peripheral myopic defocusing in controlling myopia, several types of lenses with special design have been produced and tested through prospective randomized studies. They showed an efficacy between 34 and 50% (16,17,18), but such lenses are not available on the market yet.

Extremely useful for us today is Walline’s study (19) which used DCMF (Proclear), which are available in Romania, too. This 2- year study included 40 children 8-11 years old and

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showed a reduction in myopia progression by 50% compared with monofocal CL wearers. The mechanisms of DCMF could be the reduction or removal of peripheral hyperopic defocusing, inducing a peripheral myopic defocusing or correcting on-axis hyperopia associated with accommodative lag.

**Table 1. Studies on soft multifocal contact lenses**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
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<th>Abrasion</th>
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<th>Eye movement</th>
<th>Pupil diameter</th>
<th>Diurnal variation</th>
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<td>Aksoy</td>
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<td>Southard</td>
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**Can we prescribe CL to children?**

We wonder if children will succeed to handle CL, care for them, or follow hygiene rules and if risks are greater than for adults. The answers offered by studies are more than encouraging. Li showed that 90% of children 8-11 years old can handle and care for CL alone. Compliance with caring and hygiene is better with children. The risk of complications leading to wear interruption is lower in children than in older teens and young adults.

In addition, children wearing CL have higher self-confidence and are more satisfied with their looking than those who wear spectacles.

On the other hand, fitting time is similar for children and teenagers, whilst CL training time for children is on average with only 10-15 minutes higher than for teenagers.

**What can we do for reducing myopia progression?**

Considering that myopia onset is most frequently between 6 and 9 years old and the steepest increase is just after onset, the measures to reduce its progression have to be taken as soon as we identify a child with myopia.

It is important to present the options to the child and his parents. Spectacles do not prevent progression of myopia, offering only clear vision. Daily disposable CL, recommended for convenience, good compliance and increased safety, do not have a role in preventing myopia progression, too. The options contributing to reducing myopia progression are DCMF and ortho-k lenses.

It is difficult to choose the best correction method for every single child. It depends on the child himself, as well as on parents and practitioner. Sometimes the parents hardly accept CL prescription because they may have preconceived ideas regarding their wearing by children, are afraid of possible complications or may have their experiences, sometimes unpleasant related to CL. Other parents, especially if they are CL wearers, are very receptive. Some children are fearful, do not want to touch their eyes, others want CL and hate spectacles. Some of them are unwilling to take care of CL, whilst others wish to feel free, to do sports and feel disturbed by spectacles.

The practitioner chooses the correction method depending on whether or not the myopia has progressed, on the value of the refractive error, on the patient’s family history, the parents’ myopia being a major risk factor for the progression. The choice also depends on the practitioner’s experience with different methods of correction.

**Soft multifocal or ortho-k contact lenses?**

Ortho-k lenses could be less efficient when the myopia is low (<-2.00D), as they are most beneficial to reducing the progression of higher myopia between -2.00D and -6.00D. Ortho-k lenses are able to correct myopia less than -6.00D, while DCMF can be recommended up to -8.00D. In with-the-rule myopic astigmatism, Chen demonstrates that ortho-k lenses are efficient, while toric MF lenses are expensive and there are no efficiency studies.

When the cornea is flat or the eccentricity is too low for myopia correction with ortho-k lenses we can use DCMF lenses. I do not recommend ortho-k lenses for children who have family history of keratoconus, being proved that mechanical factors are involved in keratocous development. Children who are currently wearing single-vision soft CL are easier to be switched to DCMF lenses than to ortho-k.

When both methods are equally suitable, we may choose the option of preferred correction to parents or children. The lower price of DCMF lenses may be in their favor. For children who swim would be preferred ortho-k lenses.

Often the parents prefer ortho-k lenses as they are worn inside the house during sleep, and they do not worry about losing them or about the infection risk through touching the eye with dirty hands.

**Steps for fitting children with soft multifocal contact lenses**

1. **Refraction** – always with cycloplegia for children and youth.
2. **Biomicroscopic examination of anterior chamber, tear film evaluation**
3. **Keratometry** is not essential in choosing the lens, the most important being the trial with CL.

Currently, there are available two types of DCMF lenses produced by Cooper Vision. Biofinity Multifocal has 8.6 base curve and 14.0 diameter and it is a silicone hydrogel lens with 48% water content and permeability (DK) of 128. Proclear Multifocal has 8.7 base curve and 14.4 diameter and it is a hydrogel lens with 62% water content and transmissibility of 21.3. I chose Biofinity Multifocal as first trial lens, due to higher oxygen permeability.

Choosing the power of trial lens: vertex-corrected spherical equivalent of spectacles.

**Choosing the addition of trial lens.** Although in theory higher additions would have a better therapeutic effect, such idea has not been confirmed. However, not every child can tolerate a +4.00D addition. I choose for the beginning +2.00D addition, which until now has been accepted by 32 out of 33 patients fitted with such CL.

**Put on the trial lens.** From the very beginning we try to instruct the child to put alone the lens on the eye. If he does not succeed, we instruct one parent to do this. If neither the child, nor the parent succeeds in putting the lens, we interrupt the fitting and ask the child to come back for control after 3 or 6 months. If he succeeded to put the lens, the child is asked to wait at least 10 minutes, while it is good to be allowed to play, read or walk outside.

**Fitting evaluation.** The lens has to be comfortable, to cover the cornea fully, to exceed the limb with 1-2 mm, to remain centred in all fields of gaze and to have a mobility of 0.2-0.5 mm. A special attention must be paid to centration, as decentration may be the cause of poor visual acuity.

**Evaluation of visual acuity.** Like the presbyopes, children may have ghosting of images and this must be...
explained from the beginning. The vision is clearer in good light and we can prove that by testing vision in low illumination and then in high illumination. Children must be reassured that they will accommodate and they must be encouraged to wear CL.

Instructions for children and parents. The child must be instructed to wash hands, to handle CL and to care for them. I always recommend the solution based on peroxide, for preventing allergic reactions related to preservatives and avoiding the need to clean CL in the palm. Daily wear is recommended as many hours as possible per day, as long as it is comfortable. Children and parents must be advised on the risks and specifically informed about the significant symptoms of infections, which impose interruption of CL wear. At the same time, they must be prevented not to wear CL when having a cold. Control has to be performed every 6 months.

Conclusions:
Currently, there is no protocol in place for treating myopia. However, by using ortho-k and DCMF lenses we should succeed to reduce myopia progression with at least 40%. Children do not cease growing and neither their myopia while looking forward to discovering more consistent proofs or more efficient products. Therefore, we have to use as soon as possible the products which are available now. Contact lenses with effect in reducing myopia progression should be prescribed to children, as well as to teenagers and young adults, as long as the risk of myopia progression lasts.

REFERENCES
INTRODUCTION

Pseudophakic corneal edema represents an iatrogenic corneal disease determined by cataract surgery with or without intraocular lens implantation, which consequently causes endothelial decompensation. Pseudophakic bullous keratopathy is currently one of the leading causes of corneal decompensation that generates penetrating keratoplasty. (1, 2)

In pseudophakic corneal edema, there is increased expression of inflammatory cytokines and matrix metalloproteinases. (3) Inflammatory conditions of ocular surface are secondary to the action of inflammatory cytokines and matrix metalloproteinases (MMPs). (4, 5) MMPs are a family of enzymes that includes at least 28 members, most of which share the characteristic that they are initially synthesized as inactive zymogens with a pro-peptide domain that must be removed for the enzyme to be active. This latency is the result of formation of an intramolecular complex between the cysteine residue and the zinc atom, a complex that prevents binding and cleavage of the substrate, keeping the enzyme in an inactive form. The activation consists in the dissociation of the cysteine residue from the complex. These interactions are part of the "cysteine switch", which is an activation mechanism to the "cysteine residue". (6-11) MMPs activate cytokines such as TGF-β, fibronectin, and laminin, as well as cytokines and cell surface molecules. MMPs activate cytokines such as TGF-β (by MMP-9) (12) and TNF-α (by MMP-3). (13)

MMPs were involved in the pathogenesis of several tear film and ocular surface disorders, such as dry eye disorders associated with rheumatoid arthritis (14), pterygium (15), conjunctival chalasis (16), recurrent epithelial erosions (17) and sterile corneal ulceration. (18)

Myopia is one of the major causes of visual impairment worldwide. The most important contribution of ocular parameters to myopia is the excessive elongation of the axial length of the eye. (19, 20) There are studies that show elevated levels of aqueous MMPs in the eyes with elongated axis. (21)

All currently known members of the MMPs family share the characteristic that they are initially synthesized as inactive zymogens with a pro-peptide domain that must be removed for the enzyme to be active. This latency is the result of formation of an intramolecular complex between the cysteine residue and the zinc atom, a complex that prevents binding and cleavage of the substrate, keeping the enzyme in an inactive form. The activation consists in the dissociation of the cysteine residue from the complex. These interactions are part of the "cysteine switch", which is an activation mechanism to the "cysteine residue". (22, 23)

L-cysteine is classified as a non-essential amino acid. Due to the ability of thiols to undergo redox reactions, cysteine has antioxidant properties. Cysteine's antioxidant properties are typically expressed in the tripeptide glutathione, which occurs in humans as well as other organisms. The systemic availability of oral glutathione (GSH) is negligible; so it must be biosynthesized from its constituent amino acids, cysteine, glycine, and glutamic acid. (24)

PURPOSE

To investigate the role of systemic L-cysteine as adjuvant in resolving corneal edema following cataract surgery, based on the presumption that high L-cysteine levels may act as...
regulatory substrate for MMPs (MMPs are in higher quantity in aqueous humor in myopes).

The study comprised 56 myopic patients who underwent uneventful cataract surgery and have developed epithelial corneal oedema in the postoperative period.

METHODS

This is a prospective randomized study. 56 myopic patients (AL between 24.16 – 26.73) who underwent uneventful cataract surgery were enrolled between January and May 2015. Patients were distributed in two groups: group 1 consisted in 26 patients treated with L-Cysteine, and group 2 (control group) which consisted in 30 patients who were not administered L-cysteine. Mean follow up period after cataract surgery was 4 weeks.

Every patient underwent a preoperative ophthalmic assessment which consisted in best-corrected visual acuity (BCVA), biomicroscopy, applanation tonometry, pachimetry, specular microscopy and OCT evaluation of corneal morphology and thickness.

Patient inclusion and exclusion criteria are listed below.

**Patient inclusion criteria**

1. Nuclear cataract +/- capsular cataract using “The Lens Opacities Classification System III (LOCS III)” after topical miadriatics :
   • Nuclear opacities (NO) – NO5 or NO6
   • Cortical opacities (C) – C4 or C5
2. Best corrected visual acuity (BCVA) ≤ 1/10
3. Specular microscopy minimum 1800 cells/mm² and maximum 2200 cells/mm²
4. Axial length (AL) 24-26 mm
5. Signed informed consent
6. Corneal epithelial edema first day postoperatively.

**Patient exclusion criteria:**

1. Refusal of signing informed consent
2. BCVA <1/10
3. Nuclear and cortical opalescence between 1 and 4 respectively 1 and 3 in conformity with “The Lens Opacities Classification System III (LOCS III)”
4. Posterior subcapsular cataract
5. AL< 24 mm or AL>26 mm
6. Patients that underwent surgical interventions in the target eye
7. Patients with other ocular disease: AMD, uveitis, previous corneal diseases.
8. Patients with diabetes
9. Clear cornea in the first day postoperatively.

Postoperatively, the evaluation consisted in best-corrected visual acuity, pachimetry and OCT evaluation of corneal morphology and thickness at 7, 14 and 28 days.

**L-cysteine therapeutic regimen.** In our study group, we considered the following therapeutic scheme: L-Cysteine 45mg/kg/day, NSAIDs drops TDS, AB drops TDS. In the control group, we prescribed NSAIDs drops TDS, AB drops TDS.

**Success definition.**

We have considered the following success criteria (figure no. 1):

- **criteria A** = corneal edema resolution in 7 days
- **criteria B** = corneal edema resolution in 14 days
- **criteria C** = corneal edema resolution in 28 days.

RESULTS

The study included 56 patients divided in two groups. The first group treated with systemic L-cysteine totalized 26 patients (26 eyes), with a mean age of 74,04 +/- 4.61 years old. All the patients in this group underwent uneventful phacoemulsification.

The second group was made of 30 patients with no L-cysteine postoperative administration. The mean age for this group was 73,7 +/- 3,25 years old.

Differences between the two groups were statistically significant at 7 days (p = 0,0017), but with no statistically significant differences were observed at 14 and 28 days (p > 0,05 in both cases).

There were no statistically significant differences between the two groups at one month follow-up concerning the endothelial cell count using specular microscopy (p=0.138), central corneal thickness, measured by pachymetry (p=0.220) or anterior segment OCT (p=0.431).

For Group 1 (red line) corneal edema persisted in 27% patients at 7 days, in 8% at 14 days and in 4% at 28 days after surgery. In Group 2 results were 50% at 7 days, 20% at 14 days and 7% at 28 days after surgery (Figure 4).

**Figure no. 1. Gender distribution**

**Figure no. 2. Patient percentage who accomplished success criteria A, B or C in group 1 and 2.**


21. Jia Y1, Hu DN2, Zhu D1, Zhang L1, Gu P1, Fan X1, Zhou

DISCUSSIONS

MMPs are a family of extracellular proteinases that degrade extracellular matrix proteins. The MMPs have a pivotal role in a number of pathologic processes, including angiogenesis and wound healing, where matrix degradation takes place. MMPs are activated by the “cysteine switch”. All modes of activation lead to dissociation of Cys73 from the zinc atom with concomitant exposure of the active site.(3)

In patients with pseudophakic corneal edema, there was demonstrated an increased expression of several proinflammatory mediators at the protein level in the corneal epithelium. These cytokines and MMP participate in the pathologic processes in pseudophakic corneal edema and specifically contribute to the continuous degradation of Bowman’s layer and recurrent erosions of the corneal epithelium.(25)

The assumption that MMP over expression facilitated degradation of extracellular matrix proteins prompted the development of MMP inhibitors (MMPIs) as protective agents for this pathology.

CONCLUSIONS

Systemic L-cysteine facilitated corneal oedema remission when administered in the postoperative period in patients after cataract surgery, advocating its concurrent use in patients developing edematous keratopathy. More studies are needed to clarify L-cysteine role in treating postoperative corneal edema following cataract surgery.

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MYOPIA REGRESSION AFTER CROSSTLKNGLING INTERVENTION IN THE PATIENTS WITH KERATOCONUS

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1,2,4 "Carol Davila" University of Medicine and Pharmacy, Bucharest, 3 Emergency Hospital, Pitești

Keywords: myopia, regression, keratoconus, crosslinking

Abstract This paper presents two cases with keratoconus which after the crosslinking intervention has been obtained a significant regression of myopic refraction. Crosslinking intervention was performed by "epi-off" technique, with 5.4J/cm² UVA intensity. Cases were evaluated before and after crosslinking by determining refraction, slit-lamp examination, topography and pachymetry. We note the regression of spherical and cylindrical refraction, which remained constant in time after crosslinking. It is known that crosslinking intervention is a safe method of halting the keratoconus progression, but in some cases it has the effect of spherical and cylindrical refraction decrease.

INTRODUCTION

Keratoconus is a corneal progressive ectasia in which visual acuity is decreased due to increasing of myopia, irregular astigmatism and corneal architectural changes.(1) In present, for stopping the progression of disease, phototherapeutic crosslinking intervention (CXL) is performed. This treatment method increases the corneal resistance by increasing the collagen fibers diameter and stiffness the links between those in the anterior stroma.(2) In some cases, the rearrangement of collagen fibers determines improvement of visual acuity and corneal parameters (decrease of dioptic value, increases corneal thickness, improves biomechanical parameters) besides stopping the progression of keratoconus.(3) In this paper, we present two cases with progressive keratoconus – stadium IV in which we obtained regression of corneal dioptic values and regression of spherical and cylindrical refraction besides stopping evolution after was performed crosslinking by "epi-off" method.

CASE REPORT

The first case is a 29-year old female patient, with unilateral keratoconus stadium IV in the right eye that before CXL (three years ago) presented refraction: -20 D spherical (sph.) <-8.50 D cylindrical (cyl.) axis 11; visual acuity without correction (UCVA) was 0.01. BCVA with -5 D sph. <-3.50 D cyl. axis 5 was 0.05, and BCVA with rigid contact lens (RGP) was 0.3. Corneal thickness was 409 microns and topographic map showed in figure no. 1, presents a 55 D for corneal dioptic value on the steeping meridian.

One month after CXL, we recorded -18.5 D sph. <-7 D cyl. axis 2 for refraction, improvement of UCVA at 0.02 and for BCVA with RGP contact lens at 0.5. Three months after CXL, we observed a significant regression in refraction at -17 D sph. <-5.25 D cyl. axis 9, improvement of UCVA (0.04) and BCVA with RGP contact lens (0.7).

Figure no. 1. Topographic map before CXL

Topographic recorders showed significantly corneal flattened at 51.5 D for corneal value on the highest meridian. At one year after CXL refraction, UCVA, corneal thickness, topographic aspect are maintained constant and BCVA with RGP contact lens is 10/10. Biomechanical analysis records 6.9 mmHg for corneal histerezis (CH) and 5.5 mmHg for corneal resistance factor (CRF). The check-ups performed at two and three years after CXL record -17 D sph. <-4.50 D cyl. axis 14 for refraction. BCVA with RGP contact lens 10/10 and a topographic aspect that is shows in figure 2 with 51.92 D for corneal value on the highest meridian. Also, biomechanical analysis records an improvement for CH (7.7 mmHg) and for CRF (6.6 mmHg) and a left favourable deviation on the graphic representation for percents of disease severity.

Figure no. 2. Topographic aspect at 2, 3 years after CXL
A 31-year-old female patient with keratoconus stage IV in the left eye is the second case presented in this paper.

Before CXL, we recorded -12.75 D sph. <- 7.5 D cyl. axis 13 for refraction, 0.05 for UCVA, 0.2 for BCVA with glasses (-3.50 D cyl. ax 130) and 0.7 for BCVA with RGP contact lens. Corneal thickness recorded at that time was 400 microns and corneal value on the highest meridian was 58 D (figure no. 3).

**Figure no. 3. Topographic map before CXL**

Biomechanical analysis recorded 4.5 mmHg for CH, 3.2 mmHg for CRF and 81% for severe stage. At one year after CXL performed by “epi – off” method, we observed a regression of spherical and cylindrical refraction at -8.75 D sph. <- 5.25 D cyl. axis 146, improvement of UCVA at 0.1 and BCVA with RGP contact lens at 10/10.

Topographic map is showed in figure no. 4 and we could observe the corneal value regression at 53 D on the highest meridian. Biomechanical analysis recorded 4.8 mmHg for CH and 2.3 mmHg for CRF but the graphic representation of the percents severity shows a favorable direction with a decrease at 68% for severe stage.

**Figure no. 4. Topographic map at 1 year after CXL.**

**CONCLUSIONS**

CXL by photopolimerisation reaction induces biochemical and microstructures changes at corneal stroma level. These determine the stiffness of collagen fibers and rearrangement of lamellar at corneal matrix level. Biomechanical and structural changes after CXL explain regression of refraction, corneal dioptic values regression and improvement of corneal shape.

**REFERENCES**

VISUAL ACUITY EVALUATION AFTER CROSSLINKING IN THE PATIENTS WITH KERATOCONUS

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Keywords: keratoconus, visual acuity, crosslinking

Abstract: Visual function is severely damaged in the patients with keratoconus by increasing of myopia and myopic astigmatism. In this paper, we show the evaluation of visual acuity after performing crosslinking. Method: Objective analyzes were performed by recording pre- and postoperatively the visual acuity, refraction, cornea dioptric values and cornea thickness. Subjective analyzes of visual acuity were recorded using a questionnaire evaluating visual symptoms (haloes, diplopia, photophobia, night driving difficulties) on a scale range from 1 to 5. Results: Mean age of patients was 25.42 years old. Visual acuity was improved with two Snellen lines average; its changes being correlated with decreasing of cornea dioptric values. Also, we observed a decreasing of subjective manifestation after crosslinking, especial of photophobia and diplopia. Conclusion: Crosslinking changes the cornea architecture that determines stopping of keratoconus progression and subjective and/or objective improving of the visual acuity.

INTRODUCTION

Keratoconus is a progressive disease in which corneal architectural changes are associated with the decrease of biomechanical parameters. These factors determine the decrease of visual acuity (VA) and have a negative impact on life quality.(1) For this diagnosis, the treatment objective are stopping the disease progression by photooxidative cross-linking (CXL) (2) and improving visual acuity by glasses, contact lens, corneal intrastromal rings or keratoplasty.(1)

Corneal stiffness and collagen fibers diameters increase in the anterior stroma, corneal flatted by push-up effects and tissue contraction are factors that explain the improvement of the visual acuity in some cases after CXL.(2,3,4)

PURPOSE

Objective and subjective analysis of visual function at one year after CXL was performed in the patients with progressive keratoconus.

METHODS

Is a retrospective study that included 42 cases with progressive keratoconus, CXL was performed by the “epi-off” method. Objective analysis determined VA using Snellen lines before and after CXL at one year. VA was correlated with refraction, cornea dioptric values and cornea thickness changes.

Subjective analysis evaluated photophobia, diplopia, night driving difficulties, haloes symptoms using the questionnaire answers in which these symptoms were noted from 1 to 5. 1 signified no symptoms, 2 mild symptoms, 3 moderate, 4 market and 5 severe.

RESULTS

The study included 29 male cases and 13 female cases with 25.42 years old mean age (range from 18 to 42 years old). Most cases presented keratoconus stage II or III (8 cases with keratoconus stage I, 14 cases stage II, 12 cases stage III and 8 cases stage IV. Slit-lamp examination shows Voght’s lines and Fleischer ring for most cases. Objective analysis results in mean value are presented in table no. 1.

Table no. 1. Average values before and at 1 year after CXL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Preoperatively</th>
<th>1 year after CXL</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA without correction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snellen lines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperatively</td>
<td>0.05-1.50</td>
<td>0.05-1.00</td>
<td>0.001</td>
</tr>
<tr>
<td>postoperatively</td>
<td>0.05-1.00</td>
<td>0.05-1.50</td>
<td>0.001</td>
</tr>
<tr>
<td>Spherical refraction</td>
<td>-0.84 D</td>
<td>0.58 D</td>
<td>0.001</td>
</tr>
<tr>
<td>Cylindrical refraction</td>
<td>1.27 D</td>
<td>-1.65 D</td>
<td>0.001</td>
</tr>
<tr>
<td>Corneal dioptric value on the highest meridian (K max)</td>
<td>51.34 D</td>
<td>49.58 D</td>
<td>0.001</td>
</tr>
<tr>
<td>Corneal thickness</td>
<td>540 µm</td>
<td>460 µm</td>
<td>0.001</td>
</tr>
<tr>
<td>Corneal pachymetry</td>
<td>590 µm</td>
<td>520 µm</td>
<td>0.001</td>
</tr>
</tbody>
</table>

VA without correction was improved with approximately two Snellen lines. Preoperative VA varied between 0.05 and 0.8 and postoperatively between 0.05 and 1. After CXL, VA was constant in 8 cases and it was improved with 1 Snellen lines for 8 cases, with 2 Snellen line for 11 cases, with 3 Snellen lines for 10 cases and with 4 Snellen cases for 5 cases. Spherical refraction regressed with 0.84 dioptries (D) and cylindrical refraction regressed with 1.27 D. Cylindrical refraction was constant for 9 cases, decrease with less 1D for 15 cases, with 1-2D for 15 cases and more than 2 D for 15 cases.

Corneal dioptric value on the highest meridian (K max) decreased from 51.34 D mean value preoperative to 49.58 D mean value postoperatively. This parameter was constant in 11 cases and regress with less 1 D in 4 cases, with 1-2 D in 13 cases and with more 2 D in 14 cases.

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AMT, vol. 20, no. 1, 2015, p. 47
In table no. 2, we present the changes of the average parameters value in correlation with VA changes.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>VA before</th>
<th>VA after CXL</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photophobia</td>
<td>3.4</td>
<td>2.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Diplopia</td>
<td>2.7</td>
<td>2.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Pain</td>
<td>2.0</td>
<td>1.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Night driving difficulties</td>
<td>3.3</td>
<td>2.9</td>
<td>0.4</td>
</tr>
<tr>
<td>Haloes</td>
<td>2.6</td>
<td>2.4</td>
<td>0.2</td>
</tr>
</tbody>
</table>

After CXL, we observe a decrease in perception as frequency and severity for photophobia (from 3.4 to 2.3), diplopia (from 2.71 to 2.21), pain (from 2.04 to 1.8), night driving difficulties (from 3.38 to 2.9), haloes (from 2.61 to 2.4) using question answering. For the patients with improved VA, photophobia and diplopia decreased especially. The patients in whom VA improved with more two Snellen lines, haloes manifestations decrease significantly (table no. 3).

Statistically, we demonstrate a moderate significant correlation between decreasing photophobia, diplopia manifestation and VA changes (0.4165, respectively 0.2905) and no correlation with corneal dioptric values and corneal thickness.

**DISCUSSIONS**

At one year after CXL was performed, VA without correction was improved with two Snellen lines in 61.9% cases. This is correlated with corneal dioptric values on the highest meridian with 1.76 D average, for 33.33% cases the regression was more than 2 D. Due to corneal flatted, we observe a decrease of photophobia, diplopia and haloes perception besides VA objective improvement.(4)

**CONCLUSIONS**

Phthooxidative cross-linking is the method used for halting keratoconus progression but in some cases, we can observe an improvement of VA due to corneal architectural changes.

**REFERENCES**


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CATARACT SURGERY IN MYOPIC EYES

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Keywords: L-cysteine, corneal edematopathy, cataract surgery

Abstract: Purpose: To investigate the role of systemic L-cysteine as adjuvant in resolving corneal edema following cataract surgery. Methods: The study comprised 56 patients who underwent uneventful cataract surgery and have developed epithelial corneal edema in the postoperative period. All patients received the same topical medication; moreover, 26 patients received systemic administration of L-cysteine as well. Pachymetry and anterior segment OCT were used to evaluate the patients before and after surgery (both of them were performed preoperatively, one day and one month postoperatively; OCT was performed at one week as well). Corneal endothelium was assessed using specular microscopy preoperatively and at one week and one month postoperatively. Results: At one week follow-up, central corneal thickness normalized in 19 patients (73.0%), treated with L-cysteine, compared to only 15 patients from the control group (57.7%) (p < 0.05). There were no statistically significant differences between the two groups at one month follow-up concerning the endothelial cell count using specular microscopy (p=0.138), central corneal thickness, measured by pachymetry (p=0.220) or anterior segment OCT (p=0.431). Conclusions: Systemic L-cysteine facilitated corneal edema remission when administered in the postoperative period in patients with myopia after cataract surgery, advocating its concurrent use in patients developing edematous keratopathy. More studies are needed to clarify L-cysteine role in treating postoperative corneal edema following cataract surgery.

INTRODUCTION

Pseudophakic corneal edema represents an iatrogenic corneal disease determined by cataract surgery with or without intraocular lens implantation, which consequently causes endothelial decapsulation. Pseudophakic bullous keratopathy is currently one of the leading causes of corneal decapsulation that generates penetrating keratoplasty.(1,2) In pseudophakic corneal edema, there is increased expression of inflammatory cytokines and matrix metalloproteinases.(3) Inflammatory conditions of ocular surface are secondary to the action of inflammatory cytokines and matrix metalloproteinases (MMPs).,(4,5) MMPs are a family of enzymes that include at least 28 members, most of which share the characteristic that they are initially synthesized as latent forms. The activation consists in the dissociation of the cysteine residue from the complex. These interactions are part of the “cysteine switch”, which is an activation mechanism to the cleavage of the substrate, keeping the enzyme in an inactive form. The activation consists in the dissociation of the cysteine residue from the complex. These interactions are part of the “cysteine switch”, which is an activation mechanism to the enzymatic activity of MMPs. MMPs are elevated in several ocular conditions such as dry eye disorders associated with rheumatoid arthritis (14), pterygium (15), conjunctival chalasis (16), recurrent epithelial erosions (17) and sterile corneal ulceration.(18) Myopia is one of the major causes of visual impairment worldwide. The most important contribution of ocular parameters to myopia is the excessive elongation of the axial length of the eye.(19,20) There are studies that show elevated levels of aqueous MMPs in the eyes with elongated axis.(21) All currently known members of the MMPs family share the characteristic that they are initially synthesized as inactivezymogens with a pro-peptide domain that must be removed for the enzyme to be active. This latency is the result of formation of an intramolecular complex between the cysteine residue and the zinc atom, a complex that prevents binding and activation of the enzyme.

PURPOSE

To investigate the role of systemic L-cysteine as adjuvant in resolving corneal edema after cataract surgery, based on the presumption that high L-cysteine levels may act as regulatory substrate for MMPs (MMPs are in higher quantity in aqueous humor in myopias). The study consisted of 56 myopic patients who underwent uneventful cataract surgery and have developed epithelial corneal oedema in the postoperative period.

METHODS

This is a prospective randomized study. 56 myopic patients (AL between 24.16 and 26.73) who underwent uneventful cataract surgery were enrolled between January and May 2015. Patients were distributed in two groups: group 1 consisted in 26 patients treated with L-Cysteine, and group 2 (control group) which consisted in 30 patients who were not administered L-cysteine. Mean follow-up period after cataract surgery was 4 weeks. Every patient underwent a preoperative ophthalmic assessment which consisted in best-corrected visual acuity (BCVA), slit-lamp biomicroscopy, gonioscopy, anterior segment OCT, pachymetry, and specular microscopy. The study comprised 56 patients who underwent uneventful cataract surgery and have developed epithelial corneal edema in the postoperative period.
acuity (BCVA), biomicroscopy, applanation tonometry, pachimetry, specular microscopy and OCT evaluation of corneal morphology and thickness. Patient inclusion and exclusion criteria are listed below.

**Patient inclusion criteria**
1. Nuclear cataract +/- capsular cataract using “The Lens Opacities Classification System III (LOCS III)” after topical midriatics:
   - Nuclear opacities (NO) – NO5 or NO6
   - Cortical opacities (C) – C4 or C5
2. Best corrected visual acuity (BCVA) ≤ 1/10
3. Specular microscopy minimum 1800 cells/mm² and maximum 2200 cells/mm²
4. Axial length (AL) 24-26 mm
5. Signed informed consent
6. Corneal epithelial edema first day postoperatively.

**Patient exclusion criteria:**
1. Refusal of signing informed consent
2. BCVA <1/10
3. Nuclear and cortical opalescence between 1 and 4 respectively 1 and 3 in conformity with “The Lens Opacities Classification System III (LOCS III)”
4. Posterior subcapsular cataract
5. AL< 24 mm or AL>26 mm
6. Patients that underwent surgical interventions in the target eye
7. Patients with other ocular disease: AMD, uveitis, previous corneal diseases.
8. Patients with diabetes
9. Clear cornea in the first day postoperatively.

Postoperatively, the evaluation consisted in best-corrected visual acuity, pachimetry and OCT evaluation of corneal morphology and thickness at 7, 14 and 28 days.

**L-cysteine therapeutic regimen.** In our study group, we considered the following therapeutic scheme: L-Cysteine 45mg/kg/day, NSAIDs drops TDS, AB drops TDS. In the control group, we prescribed NSAIDs drops TDS, AB drops TDS.

**Success definition.**
We have considered the following success criteria (figure no. 1):
- Criteria A = corneal edema resolution in 7 days
- Criteria B = corneal edema resolution in 14 days
- Criteria C = corneal edema resolution in 28 days.

**RESULTS**
The study included 56 patients divided in two groups. The first group treated with systemic L-cysteine totalized 26 patients (26 eyes), with a mean age of 74.04 +/- 4.61 years. All the patients in this group underwent uneventful phacoemulsification. The second group was made of 30 patients with no L-cysteine postoperative administration. The mean age for this group was 73.7 +/- 3.25 years.

Gender distribution is represented in figure no. 1. **Corneal edema resolution.** In L-cysteine group, corneal edema resolution after 7 days occurred in 73% of patients (criteria A), after 14 days it occurred in 92% of patients (criteria B) and after 28 days in 96% of patients (criteria C). In the second group, criteria A were accomplished in 50% of patients, criteria B in 80% and criteria C in 93% of patients (figure no. 2).

For Group 1 (red line) corneal edema persisted in 27% patients at 7 days, in 8% at 14 days and in 4% at 28 days after surgery.

In Group 2, the results were 50% at 7 days, 20% at 14 days and 7% at 28 days after surgery (figure no. 4).
MMPs are a family of extracellular proteinases that degrade extracellular matrix proteins. The MMPs have a pivotal role in a number of pathologic processes, including angiogenesis and wound healing, where matrix degradation takes place. MMPs are activated by the “cysteine switch”. All modes of activation lead to dissociation of Cys73 from the zinc atom with concomitant exposure of the active site.(3) In patients with pseudophakic corneal edema, it was demonstrated an increased expression of several proinflammatory mediators at the protein level in the corneal epithelium. These cytokines and MMP participate in the pathologic processes in pseudophakic corneal edema and specifically contribute to the continuous degradation of Bowman’s layer and recurrent erosions of the corneal epithelium.(25) The assumption that MMP over expression facilitated the degradation of extracellular matrix proteins prompted the development of MMP inhibitors (MMPIs) as protective agents for this pathology.

REFERENCES

DIFFICULTIES IN CATARACT SURGERY IN A PATIENT WITH HIGH MYOPIA AND IFIS SYNDROME. CASE REPORT

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Keywords: cataract, high myopia, intraoperative floppy iris syndrome (IFIS)

Abstract: We present a patient with high myopia, nuclear cataract and benign prostatic hypertrophy under treatment with Tamsulosin. Intraoperative difficulties are highlighted and they are generated by myopia and IFIS syndrome occurred intraoperatively (insufficient mydriasis, iris prolapse, iris heretical behaviour).

INTRODUCTION

Hydrodissection and hydrodelineation present some particularities in the patients with myopia. There are strong adherences at the interface level with the nucleus, epinucleus, cortex and capsule. To minimize stress on the zonules and on the capsular bag during manipulation of the nucleus a good hydrodissection is very important. In myopic eyes, it is important to make a complete hydrodissection. The zonules are very weak and trauma to them can cause subluxation of the lens. Emulsification of the nucleus suffers some modifications. As myopic eyes have fragile zonules, liquefied vitreous, thin sclera, introducing the phaco in the AC (pressing the infusion) determines a positive pressure that deepens the AC and pushes the iris in the periphery (breathing phenomenon). The bottle height should be lowered and it is recommended to use a Kelman tip. Ultrasound power should be higher, as the cataract is harder than that we see at the slit lamp; insufficient power leads to unfragmentation of the nucleus and pushes it posteriorly producing a stress on the posterior capsule and zonules with rupture of the capsule and zonular dehiscence. Techniques used are stop & chop and Divide & conquer. In case of supracapsular cataract the nucleus is prolapsed in the AC after hydrodissection and then aspirated with maximum vacuum.

Cortex aspiration and capsular polishing prevents opacification of the posterior capsule.

Implantation of the PC IOL is done at intrasacular level, this being a hydrophobic acrylic lens which decreases the frequency of PCO.(11)

Alpha blockers link with high affinity and specificity to receptors alpha 1-type A, receptors located at the level of: prostate, bladder and also at the level of iris. Tamsulosin is the only systemic alpha 1 antagonist that is selective for the subtype alpha 1A receptor. It inhibits competitively the sympathetic nervous system determining the relaxation of smooth muscles from the peripheral vascular level, neck of cholecyst and prostatic ureter.(1,2) It is used in the treatment of benign prostatic hypertrophy BPH.

Clinical manifestations of IFIS that complicated cataract surgery are insufficient preoperative pupil dilatation. Intraoperative iris prolapse and progressive myosis. Most of the patients taking selective alpha1 blockers develop IFIS during cataract surgery, sometimes only one of the signs may manifest among the triad.

REFERENCES

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We will present the case of a male patient, A. G of 78 years old, from an urban area, retired, who was admitted for decreased visual acuity at the RE. Family history is not relevant to the disease. Personal history we retain primary HBP, DM-NIID, mixed diabetic polyneuropathy of the inferior limbs, prostatic adenoma, AO: High myopia with astigmatism. Patient currently taking the following medications: Betaloc zok, Prestarium, Amlodipin, Aspenter, Sortis, Siofor, Thiogamma, Tamsulosin. The actual disease started insidious, by decreased visual acuity at the RE about 1-2 years.

### Ocular exam:

- **VARE** = 4/50 cc (-8.25 ≈ -1.75x650)
- **VALE** = 0.5 cc (-6.00 ≈ -1.00x900)
- Keratometry RE: 7.78 (550) 7.68 (1450)
- LE: 7.84 (800) 7.67 (1800)
- Refractometry RE: -8.00 ≈ -1.75x650
- LE: -6.00 ≈ -1.00x900

### Biomicroscopy:

- BE: nuclear opacification having a brown hue (RE>LE)
- IOP RE=19 mmHg; LE=17 mmHg
- Fundoscopy BE: papila with myopic conus peripapilar, zones of corioretinal atrophy in the periphery, vitreous floaters.

**Biometry using SRK-T formula (table no. 1).**

<table>
<thead>
<tr>
<th>RE</th>
<th>LE</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0.00</td>
<td>+0.00</td>
</tr>
<tr>
<td>+0.00</td>
<td>+0.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RE</th>
<th>LE</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0.00</td>
<td>+0.00</td>
</tr>
<tr>
<td>+0.00</td>
<td>+0.00</td>
</tr>
</tbody>
</table>

### Positive diagnosis:


Surgical treatment involves removing the cataract, aiming to recuperate the visual function. Technique used was phacoemulsification of the crystalline lens and implantation of PC-IOL- (Acrysoft IQ, SN 60WF)(Fig 1-6).

**Intraoperative steps:**

- Side- port at 6 (the maintainer) at 3 and 9 o’clock (figure no. 7);
- Iris retractors (figure no. 8);
- Coloring of the posterior capsule (figure no. 9);
- Capsulorhexis needle (figure no. 10);
- Hidrodisection and hidrolineation;
- Introduction of viscoelastic in AC;
- Phacoemulsification - Stop & Chop (figure no. 11);
- Remaining cortex aspiration;
- Introducing artificial lens (figure no. 12) intrasacular level.

Postoperatively, the patient was treated with Diclofenac 2x1 capsule/ day. 5 days and locally with Tobradex 5x1 drops/day 4 wks and mydriatics 2-3 days.

**Ocular exam at 6 weeks:**

- **VARE** = 0.6-0.7 cc (-5.00 ≈ -1.50x650)
- **VALE** = 0.5 cc (-6.00 ≈ -1.00 x900)
- **IOP** RE: IOL-CP well centred
- LE: nuclear opacification

6 months later, we operated the LE for cataract taking care prophylactically of the IFIS syndrome. I

The intraoperative steps were the following:

- Side- port at 6 (the maintainer) at 3 and 9 o’clock (figure no. 7);
- Iris retractors (figure no. 8);
- Coloring of the posterior capsule (figure no. 9);
- Capsulorhexis needle (figure no. 10);
- Hidrodisection and hidrolineation;
- Introduction of viscoelastic in AC;
- Phacoemulsification - Stop & Chop (figure no. 11);
- Remaining cortex aspiration;
- Introducing artificial lens (figure no. 12) intrasacular level.
Ocular exam at 6 weeks after surgery to the LE:
VARE = 0.6-0.7 cc (-5.00 ≈ -1.50 x 900)
VALE = 0.8 cc (-6.00 ≈ -1.00 x 900)
BE: IOL-CP well centered.

DISCUSSIONS

Floppy iris (IFIS) was first described by Chang and Campbell (2005).(1) This occurs in those who take Tamsulosin (Flomax) for benign prostatic hypertrophy. Tamsulosin blocks alpha1-adrenergic receptors, with effects on dilator muscle of the iris receptors.

IFIS syndrome is characterized by: difficult dilatation of the pupil preoperatively, elasticity of the iris margins, floppy iris, iris prolaps through the incision and progressive miosis intraoperatively. It has a frequency of 2% of the total population who underwent cataract surgery.

In IFIS syndrome, Tamsulosin leads to decreased iris thickness, atrophy of the dilator muscle of the iris with decreased structural rigidity of the iris relative to the hydrostatic forces that are present in the AC during phacoemulsification.

IFIS prophylaxis can be done by using intracameral Fenilefrin or Epinefrin, using viscoelastic substances having high molecular weight (Healon 5), iris hooks (iris dilators, iris expander), by modifying the intraoperative parameters (decrease flow-rate, bimanual I-A).(2)

Recognition of IFIS syndrome is important for reducing intraoperative complications.

REFERENCES


GLAUCOMA AND MYOPIA

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Abstract: Glaucoma is a progressive optic neuropathy and one of the leading causes of irreversible blindness in the adult population worldwide. Primary open angle glaucoma (POAG) is the most commonly reported type of glaucoma in population based prevalence studies worldwide. Many studies have investigated and reported risk factors associated with glaucoma. The major mentioned risk factor in this pathology is the elevated intraocular pressure. There is growing evidence that other risk factors like age, gender, race, refractive errors, heredity and systemic factors may play a role. High myopia is a major cause of legal blindness in many developed countries. It is also a risk factor for the development and progression of glaucoma (epidemiologic evidence) because, as we know, it can determine structural and functional defects which can’t always be differentiated from those caused by glaucoma.

The correlation between glaucoma and high myopia has always been a big diagnostic and therapeutic challenge. Through this article we will try to elucidate some well-known questions:

- Is there any anatomic correlation?
- Is there any genetic correlation?

Prevalence

The global prevalence of glaucoma was 60.5 million people in 2012, 74% POAG, 47% Asians and 59% women.

The prevalence of myopia varies across populations of different regions and ethnicities. In population-based studies, the prevalence of myopia has been reported to be higher in urban areas and in Asian populations than in populations of European descent, especially in the younger generations in recent decades. High myopia is present in 0.5% of population based prevalence studies worldwide. Many studies have investigated and reported risk factors associated with glaucoma. The major mentioned risk factor in this pathology is the elevated intraocular pressure. There is growing evidence that other risk factors like age, gender, race, refractive errors, heredity and systemic factors may play a role.

High myopia is a major cause of legal blindness in many developed countries. It is also a risk factor for the development and progression of glaucoma (epidemiologic evidence) because, as we know, it can determine structural and functional defects which can’t always be differentiated from those caused by glaucoma.

Pathogenesis

In glaucoma there are two well-known major theories: ‘the mechanical theory’ and ‘the vascular theory’. The mechanical theory hypothesizes that an elevated IOP compresses the optic nerve head, leading to the death of RGCs and their axons and resulting in thinning of the neuroretinal rim and excavation of optic nerve head. (3) In the vascular theory, glaucomatous optic neuropathy is considered to be a consequence of insufficient blood supply because of either increased IOP or other causes that reduce ocular blood flow, such as low systemic blood pressure or vasospasm.(4)

High myopia is a complex trait including both genetic and environmental factors as well as gene-environment interactions.(5) It consists of excessive and progressive elongation of the AP axe with structural changes (scleral, choroidal, retinal and macular defects). High myopia is associated with an increased risk of pathological ocular complications and may lead to blinding disorders such as premature cataracts, glaucoma, retinal detachment, and macular degeneration.

The mechanisms responsible for the link between glaucoma and myopia are poorly understood for the moment. The increased susceptibility of the optic nerve head to damage by raised IOP in myopic eyes (because of the existent changes in connective tissue structure and arrangement) is one of the mentioned mechanisms. Also, the RNFL thinning (in already reduced RNFL because of myopic eyes), gives an increased risk in developing glaucomatous changes.

Populational studies

The association between myopia and glaucoma has been explored for nearly a century. Population-based studies indicate that the risk of glaucoma increases with the increasing degree of myopia, mainly suggesting that moderate to high myopia is associated with increased risk of POAG.

The Blue Mountains Eye Study, done in Australia on 3654 people (49-97 years old), found a strong relationship between POAG and myopia. Myopic subjects had a twofold to threefold increased risk of glaucoma compared with that of nonmyopic subjects. The risk was independent of other glaucoma risk factors and IOP.

The Barbados Eye Study, done in Barbados, West Indies, on 4709 participants, (40 - 84 years old) stated that a
myopic refraction was one of several risk factors for POAG in adult black people.

The Beaver Dam Eye Study, done in Beaver Dam, Wisconsin, on 6000 people (43 - 84 years old), showed that persons with myopia were 60% more likely to have glaucoma than those with emmetropia.

The Singapore Malay Eye Study, done in Singapore, on 3280 people, showed that persons with moderate or high myopia had an almost 3 times higher risk of POAG compared with those with emmetropia.

The Beijing Eye Study, done in Beijing, on 4439 people > 40 years old, stated that marked to high myopia with a myopic refractive error exceeding - 6 D may be a risk factor associated with glaucomatous optic neuropathy.

The Early Manifest Glaucoma Trial, one of the largest screening surveys of myopia and glaucoma, done in Sweden, on 32,918 individuals, found that the prevalence of newly detected glaucoma increased with increasing myopia (P=0.0001) across all age groups.

The Los Angeles Latino Eye Study, done in Los Angeles, on 5277 Latino participants, found that the association between myopia and visual field defects may represent an increased risk of glaucoma among myopes and suggested a need for greater glaucoma surveillance in this population.

Diagnosis
The most common questions when we are talking about diagnosis are:

- Is it glaucoma? Or is a condition that looks “like glaucoma”?
- At presentation is high myopia but looks “like glaucoma” also.
- Are we sure about the diagnosis?!

Glaucoma is a progressive glaucomatous optic neuropathy, characterized by the loss of retinal nerve fiber tissues and recognized clinically by visual field defects and loss of the neuroretinal rim. In this context, high myopia defects can be a confusion factor. Tilted discs, peripapillary atrophys and staphylomas may make it difficult to distinguish glaucomatous optic neuropathy from myopia-related optic nerve and retinal abnormalities.

Optic disc size
The optic disc size is bigger in high myopia but it has individual variation, depending also on the race (Caucasians < Asians and afro-americans). A macrodisc can be defined as being larger than average disc + 2 SD. It can be divided in primary and secondary, acquired macroadisc. The size of primary macroadiscs is independent of age and of refractive error. In contrast, the secondary or acquired macroadisc increases in size after birth and occurs in eyes with high myopia. The secondary macroadisc can be further subclassified into eyes with primary high myopia due to reasons yet unknown and eyes with secondary high myopia due to congenital glaucoma.

The variability in optic disc size is morphogenetically and pathogenetically important. Morphogenetically, a macroadisc implies more optic nerve fibers, less nerve fibers crowding / mm² of disc area, more cilio-retinal arteries, more photoreceptors, more retinal pigment epithelium cells. Pathogenetically speaking, the variability of optic disc size is important because some optic nerve anomalies and diseases are correlated. Pits of the optic disc and the morning glory syndrome are more common in large optic nerve heads.

In all glaucoma eyes with high myopia, including the highly myopic type of primary open angle glaucoma, the optic disc is abnormally large. These secondary macroadiscs are considered to be due to the myopic stretching of the posterior pole. In the assessment of the optic disc size, the larger the optic disc is, the larger are the optic cup and the neuroretinal rim, so a large cup in a large optic disc can be normal.

Optic disc shape
In miopes under - 8 D, normal eyes and glaucoma eyes do not differ significantly in optic disc shape. In highly myopic patients, the optic disc is more oval and more elongated, obliquely - oriented (more pronounced over -12 D). The myopic stretching in highly myopic eyes, leading to secondary macroadisc, does not exert a similar traction on the optic disc in all meridians, this being a pertinent speculation that there is higher susceptibility for RNFL damage in presence of normal IOP measurements.

Peripapillary atrophy
There are histologically differences between α and β zones in high myopia and in glaucoma. In the region of the myopic crescent, only the inner limiting membrane and retinal nerve fiber layer cover the sclera while in glaucomatous beta zone, bruch’s membrane and the choroid is interposed between retina and sclera.

Imaging
The two most commonly used contemporary modalities for imaging the optic nerve are:

- stereo disc photos (implies subjective interpretation)
- automated SD-OCT (implies objective interpretation on RNFL, ganglion cell and optic nerve parameters)

An important advantage of disc photos is that a captured picture serves as a direct comparison indefinitely and it serves as a reliable reference to observe enlarged cupping, new notching or new RNFL defects, bayoneting of the vessels, increasing peripapillar atrophy and other features characteristic of glaucoma.

SD-OCT result can be normal, borderline or outside the range. A disadvantage is that there are various SD-OCT machines, thus making direct comparisons impossible. Some SD-OCT algorithms tend to measure thinner RNFL and macular thickness in myopia. A recent study of neuroretinal rim parameters with SD-OCT in high myopic eyes demonstrated that 15 – 20% patients had a measurement error as a result of large areas of peripapillary atrophy, severely tilted discs, or vitreous opacities. (6,10)

Retinal nerve fiber layer assessment
RNFL measurement is sensitive for detection of early structural change in glaucoma. Numerous studies have confirmed that RNFL measurement is sensitive for detection of glaucoma, and the extent of RNFL damage correlates with the severity of functional deficit in the visual field. High myopia progression causes decrease in RNFL thickness, and the increasing axial length produces a decrease in the RNFL bundles. Also, variation of RNFL distribution bundles may be related to the shape of the globe with asymmetrical anteroposterior elongation and/or posterior staphyloma that is characteristic seen in those with myopia. This draws the bundles closer to the macula as compared to the anatomy in those with relatively more spherical emmetropic eyes.

Visual field
Classic untreated POAG often presents with an arcuate visual field defect in one hemifield, followed by similar loss in the other hemifield, respecting the horizontal midline.

Myopia is associated with localised damage of optic nerve, sometimes the superior or inferior rim, with relative sparing of the other half of the nerve. Myopia can produce visual field defects “like-glaucoma” because of tilted discs, peripapillar atrophys or staphylomas.
Visual field results are optimal when used optical correction; also the type of optical correction used is important. In this type of investigation the recommendation is to have 1-2 basal tests done and then periodical testing is indicated for detecting progression.

*Other glaucomas and myopia*

**PACG and myopia**

There are some poputational studies which relate the two pathologies:

- in Singapore: 33% of the patients with occludable angle have myopia.
- in Australia: 7 from 127 eyes with PACG have myopia (5.5%)

**NTG and myopia**

In this association, the differential diagnosis is difficult. Patients with high myopia and tilted discs, peripapillary atrophy and big C/D ratio, can determine nonprogressive defects but with glaucomatous aspect on the visual field. Can this mean NTG?

Also, a non-tilted disc can give focal defects (wedge-shape) on visual field, mimicking an arcuate defect (usually because of the lenses that correct the refractive error). In these cases, we recommend thorough follow-up, eventual diurnal IOP determination could help. If there is progression, we recommmend treatment for IOP lowering.

**Pigmentary glaucoma and myopia**

Typically young, myopic, male patients have pigmentary glaucoma. It is stated that patients with high myopia develop earlier pigmentary glaucoma but there are no consistent data correlating the two pathologies.

**Congenital glaucoma and myopia**

The scleral envelop resists the initial distensile pressure. But after a level, a slowly increasing intraocular pressure succeeds in distending the scleral envelop, without causing chorioretinal changes, resulting in a distended eyeball (buphthalmia) and ending in myopia.

In 50% of the operated congenital glaucomas there is a degree of visual loss which may be due to large refractive errors (high myopia) with anizometropia, and amblyopia, persistent optic disc cupping, nystagmus or corneal defects.

!! Any rapidly progressive myopia in children needs glaucoma examination.

**Management**

What should we do in case of a young, high myopic patient, with a tilted optic nerve, C/D ratio apparently glaucomatous and a visual field defect suggesting POAG, with normal or at limit IOP?!

Should we start treatment or should we initiate a thorough follow-up to detect progression?

If it is progressing, is it because of myopia or glaucoma?

As we see, this is a difficult and complex decision.

Recommendations for a high myopic patient suspected or diagnosed with glaucoma:

- Follow the optic nerve, take photos, document its appearance over time. If you see changes then glaucoma is progressing.
- Follow visual field, the changes aren’t always the result of glaucoma (there are other types of optic nerve damage or myopic retinal degeneration). The degree of severe visual field defect (severe alteration and fixation threatening) should be correlated with patients’ life-expectancy.
- Follow IOP, high myopia is less able to tolerate IOP fluctuations. A longer globe, a thinner lamina cribrosa, a thinner scleral wall, with different elasticity and an IOP increase can cause posterior pole damage without abnormal IOP readings.

Observation is indicated and medical treatment ± laser. Caution in setting a very low IOP goal at presentation. Treatment benefits and risks should be counted.

Treat each case differently, take into account family history, your own comfort level with following versus treating and the patients compliance for treatment and long follow-up.

No aggressive treatment is recommended.

Watch out for former high myopes, that is, patients whose myopia was reduced or eliminated by refractive surgery. Even though their refractive status has been improved by a keratorefractive procedure, their elongated eye structure and optic nerve status remain unchanged.

Avoid filtration surgery, if possible. If necessary, be cautious. Given the inherent risks involved, surgery is most appropriate in patients in whom the location and rate of progression suggest a significant risk of the patient becoming symptomatic. People with high myopia have a greater chance of hypotony maculopathy after surgery, particularly young high myopes, who have a thinner, less rigid scleral wall. In such patients, the scleral wall tends to collapse easily when the pressure is lowered after glaucoma surgery.

Trabeculectomy needs special measures in high myopia. Risc of globe perforation at anesthesia, risc in using anti-metabolites (scleral thinning, endoftalmitis), post-operative complications (choroidal detachment due to scleral thinning and choroidal vascularization vulnerability), late hypotony, hipotony maculopathy, are a few of the complications that needs mentioning.

Non-penetrating glaucoma surgery is a better option because of the progressive slow lowering of IOP which assures lowering of postoperative complication prevalence. This technique is preffered also in combined cataract surgery. It is a difficult technique (thin scleral flap, Schlemm’s canal identification).

Hamel M, Shaarawy T, Mermoud A published a study about deep sclerectomy and collagen implants in patients with high myopia. The results were encouraging, stating that “eighty-one percent of patients achieved an IOP below 21 mm Hg with or without medication at 48 months. Thirty-eight percent had an IOP below 21 mm Hg without medication. The mean number of medications per patient was reduced from 2.30 +/- 0.85 to 0.86 +/- 0.91”.(11)

**CONCLUSIONS**

Increasing evidence indicates that high myopia is an important risk factor in the pathogenesis of glaucoma, especially for POAG (although increased IOP remains the major risk factor for this condition).

Myopia as a risk factor for glaucoma is supported by population based surveys.

For the individual, the link between myopia and progression of glaucoma remains controversial.

It is important to investigate factors of refractive errors associated with glaucoma in longitudinal studies.

Further prospective, clinical and epidemiological studies will improve our understanding of the pathogenesis of glaucoma.

High myopic subjects should be screened for glaucoma at closer intervals.
**Take home message**

A number of studies suggest that myopia is a risk factor for glaucoma but there may be an alternative explanation for the reported association.

**REFERENCES**