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Abstract

## **The significance of the correct fit of RGP contact lenses for visual acuity**

Luka Kuburić

University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina, Serbia; e-mail: [lukakubura@gmail.com](mailto:lukakubura@gmail.com)

Luka Vasiljević

University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina, Serbia; e-mail: [lukavasiljevic654@gmail.com](mailto:lukavasiljevic654@gmail.com)

Livija Temunović

University of Novi Sad, Faculty of Sciences, Department of Physics, Novi Sad, Vojvodina, Serbia; e-mail: [livija.hoya@gmail.com](mailto:livija.hoya@gmail.com)

### Summary

RGP, or "rigid gas permeable lens", represents a hard, gas-permeable contact lens used as an optical aid in the correction of refractive anomalies such as myopia, hypertherapy, and astigmatism. They are characterized by high oxygen permeability, resistance to deposits, good maintenance of corneal metabolism, exceptional optical characteristics and sometimes the only solution for correcting the refractive error of the patient. This study describes how different fitting of this contact lenses affects visual acuity of the patient along with some photos of different types (models) of fitting.

Keywords : Contact lenses, RGP CL, visual acuity, correct fitting

# **ISTRAŽIVANJE ZADOVOLJSTVA OPTOMETRISTA ZAPOSLENIH U SPECIJALIZOVANIM OFTALMOLOŠKIM BOLNICAMA U SRBIJI**

Dr Nevena Ćurčić, Marija Miličević  
Univerzitet u Novom Sadu  
Prirodno-matematički fakultet

## **Rezime**

Rad u specijalizovanim oftalmološkim bolnicama zahteva punu posvećenost i saradnju tima koji radi na istom zadatku. Istraživanje koje je sprovedeno u Novom Sadu i Beogradu ispitalo je u kojoj meri su optometristi zadovoljni svojim radnim mestima u specijalizovanim oftalmološkim bolnicama i gde vide propuste u organizaciji procesa rada. Analiza je rađena u odnosu na dužinu radnog iskustva, pripadnost određenoj starosnoj grupi i u odnosu na pol ispitanika. Na osnovu dobijenih rezultata moguće je otkriti slabe tačke u organizaciji procesa rada koje su prepoznali optometristi, utvrditi razloge njihovog nezadovoljstva i shodno tome bolje sistematizovani poslove i zaduženja optometrista.

Ključne reči: optometrista, oftalmološka bolnica, organizaciji procesa rada.

## **RESEARCH OF THE SATISFACTION OF OPTOMETRIST EMPLOYEES IN SPECIALIZED OFTALMOLOGICAL HOSPITALS IN SERBIA**

### **Abstract**

Working in specialized ophthalmic hospitals requires full commitment and cooperation of the team working on the same task. A survey conducted in Novi Sad and Belgrade examined the extent to which optometrists are satisfied with their jobs at specialized ophthalmic hospitals and see failures in organizing the work process. The analysis was made in relation to the length of work experience, belonging to a certain age group and in relation to the sexes of the respondents. On the basis of the obtained results, it is possible to detect weak points in the organization of the work process recognized by optometrists, to determine the reasons for their dissatisfaction and consequently better systematized tasks and duties of optometrists.

Keywords: optometrist, ophthalmic hospital, organization of the process of work.

# ULTRASOUND METHODS FOR MEASURING AXIAL EYE DIMENSIONS

Authors: Marta Avramović<sup>1</sup>

<sup>1</sup>University in Novi Sad, Faculty of Sciences, Trg Dositeja Odradovića 3, 21000  
Novi Sad, Serbia

## 1. ULTRASOUND

Ultrasound is a longitudinal mechanical wave with frequencies greater than 20 kHz. Ultrasound is well spread through the liquid and solid, and reflects on the border of two different areas and because of that is widely used in medicine. Ultrasound frequencies of MHz order are used for imaging various organs and tissues in the human body. In ophthalmology and optometry ultrasound sonography is considered as non-invasive technique that provides information of the size and structure within the eye. Ultrasound sonography is especially used when conventional methods of examination are insufficient to provide accurate diagnoses.

## 2. ONE-DIMENSIONAL A-SCAN ULTRASONOGRAPHY

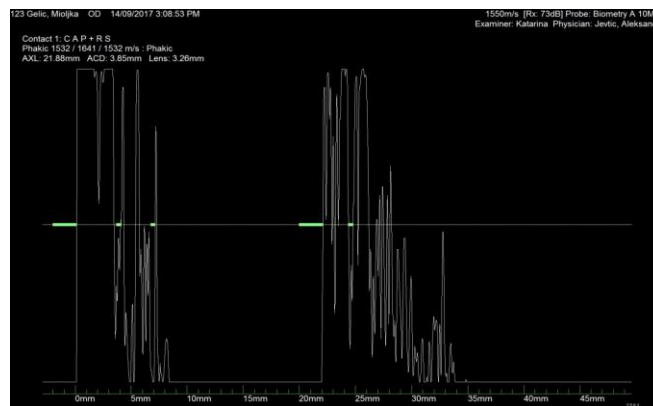
Amplitude scanning (*A-scan*) is an ultrasound method that is almost exclusively used for eye biometrics. *A-scanning* probe is rod-shaped, using 8–12 MHz frequencies. *A-scan* name comes from the fact that this technique shows the size of the amplitude of the reflected wave (*A*-amplitude). The internal elements of the eye are visualized by recording reflections of ultrasound waves from the internal eye tissue. Echoes (reflection from the boundary surfaces) returns to the probe and after being processed are displayed on the screen as white peaks (Figure 2). Each peak corresponds to a reflection from one boundary area, so the distance between the peaks is used to calculate the distance between the various structures in the eye.

There are two *A-scanning* techniques, immersion and contact (direct) (Figure 1). In the immersion technique, the probe is not directly attached to the cornea as in the case of contact technique, but is dipped into a small silicone tube with a liquid, which gives greater comfort to the examined person. In contact technique, the cornea is anesthetized because there is direct contact between the cornea and the probe. Immersion technique is proved to be a more precise method for measuring the value of the axial length of the eye because the compression of the cornea is avoided. Accurate eye biometrics is very important especially when it comes intraocular lens surgery.



**Figure 1.** Immersion and contact technique A-scan methods

The results of the A-scan ultrasonography using contact technique are shown in Figure 2. The first green horizontal line indicates the point of contact of the probe and cornea, while the other two represent the front and the back of lens capsule. The space between them represents the thickness of the lens. The last two horizontal green lines indicate the location of the retina and sclera with further propagation and attenuation of the signal through the orbital tissue.



**Figure 2.** The results of the A-scan ultrasonography using contact technique

Ultrasound echo peaks shown (Figure 2) within the lens can be explained by dense opacities by type of cataract. High levels of ultrasonic signal reflections are characteristic of the retina and sclera, while the intensity of the ultrasound beam is gradually weakened passing through the orbital tissue.

### **Acknowledgment**

I wish to acknowledge the help provided by Dr. Oliveri Klisurić and Dr. sci. med. Sava Barišić.

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# ИСТРАЖИВАЊЕ ЗАДОВОЉСТВА ОПТОМЕТРИСТА ЗАПОСЛЕНИХ У СПЕЦИЈАЛИЗОВАНИМ ОФТАЛМОЛОШКИМ БОЛНИЦАМА У СРБИЈИ

Др Невена Ђурчић, Марија Миличевић

*Универзитет у Новом Саду, Природно-математички факултет  
Трг Д. Обрадовића 3, 21 000 Нови Сад*

## 1. УВОД

На савременом радном месту, где запослени по правилу проводе више времена него у било којем другом друштвеном окружењу (што укључује и односе са пријатељима и породицом), неопходно је омогућити да запослени осећају одговарајући ниво задовољства при раду, како би се одржала мотивација за рад и континуирано постизали зацртани пословни циљеви. У стимулативном окружењу могу се очекивати и надпросечни резултати рада, што доприноси увећаном пословном успеху и унапређењу положаја самог послодавца у конкурентном пословном окружењу у условима слободне тржишне економије [1].

Задовољство на радном месту од посебног је значаја у оптометријској струци, као услужној делатности, у којој запослени у предузећу долазе у непосредан контакт са примаоцима услуга, креирајући слику о самом предузећу и учествујући у стварању утиска о пруженој услузи.

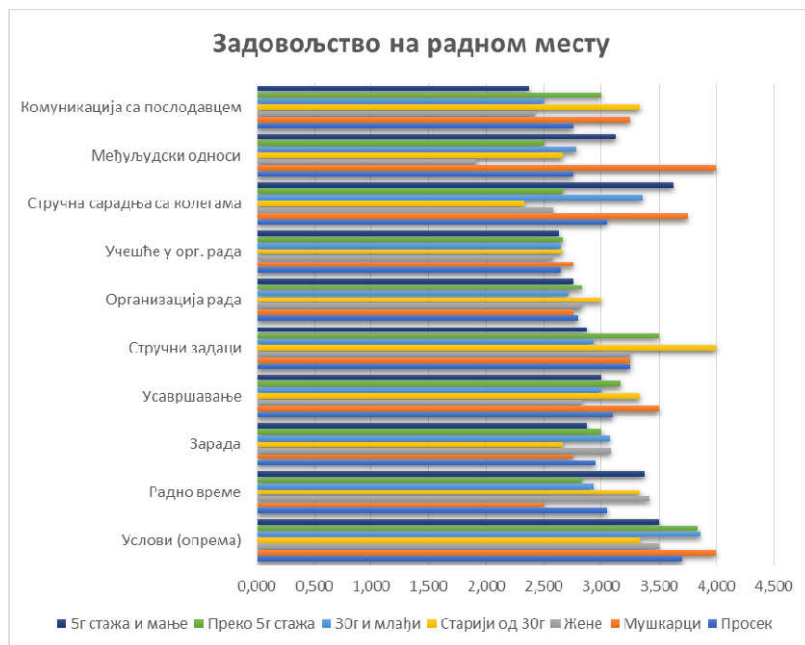
Веће задовољство запосленог се пресликава на квалитетнији рад са примаоцима услуге (пацијентима у офталмолошкој болници), што доприноси већем задовољству услугом и повољнијој перцепцији квалитета услуге од стране пацијената [2] [3].

## 2. ЗАДОВОЉСТВО НА РАДНОМ МЕСТУ

Резултати истраживања показали су да **оптометристи не показују висок ниво задовољства својим радним местом**. Узимајући у обзир просечне одговоре свих испитаника на питања којима се тражила оцена задовољства на радном месту, просечна оцена задовољства на радном месту износи 3,005.

Највећи степен задовољства исказан је по питању техничких услова рада, тј. нивоа опремљености радног места (просечна оцена 3.7), док је међу осталих девет категорија оцењивања задовољства, чак пет категорија оцењено исподпросечном оценом: испод оцене 3 вредновано је задовољство зарадом (2.95), организацијом рада (2.8), учешћем запосленог у организацији рада (2.65), међуљудским односима у колективу и

комуникацијом са послодавцем (оба оцењена са 2.75). У распону од 3.05 до 3.25 кретало се задовољство радним временом и стручном сарадњом са колегама (по 3.05), док су прелазну оцену још добили задовољство могућношћу стручног усавршавања (3.1) и задовољство количином стручних радних задатака у свакодневном раду (3.25).



Слика 1. Задовољство оптометриста на радном месту

Резултати показују да су мушкарци оптометристи нешто задовољнији својим радним местом у односу на жене (просечне оцене 3.25 и 2.842). Код жена је посебно приметан изузетно низак степен задовољства међуљудским односима на радном месту (просечна оцена 1.917 у односу на 4.0 код мушкараца), док је код мушкараца нижи степен задовољства радним временом у односу на жене (2.5 у односу на 3.417).

Млађи оптометристи имају готово истоветан степен задовољства радним местом као и њихове старије колеге (просечна оцена 3.067 за оптометристе са више од 30 година старости, наспрот 2.979 са 30 и мање година; просечна оцена 3.0 за оптометристе са више од пет година радног стажа, односно 3.013 са пет и мање година). Ипак, разлике између искуснијих и млађих колега утврђене су у погледу задовољства количином стручних радних задатака, где су старије колеге знатно задовољније својом улогом на радном месту (оцена 4.0 за запослене старије од 30 година, наспрот 2.929 за млађе; 3.5 за запослене са преко 5 година радног

стажа насупрот 2.875 за оне са мањим стажом), док млађе колеге боље оцењују своје задовољство стручном сарадњом са колегама на радном месту (оцена 2.33 за запослене старије од 30 година, насупрот 3.357 за млађе; 2.667 за запослене са преко 5 година радног стажа насупрот 3.625 за оне са мањим стажом).

### 3. ЗАКЉУЧАК

Резултати анкете показују да оптометристи у највећој мери нису задовољни својим радним местом у домаћим специјализованим офталмолошким болницама. У намери послодавца да приступи системском решењу овог проблема, показало се да се не може приступити на исти начин свим категоријама запослених, будући да различите групе имају различита искуства у раду и виђења радног окружења, те да на различит начин вреднују карактеристике рада у специјализованим офталмолошким болницама.

Најпре је утврђено да су запослени у највећој мери разочарани организацијом рада код послодавца, као и сопственим учешћем у тој организацији. Унапређењем овог сегмента може се очекивати да би се унапредило и задовољство међуљудским односима, који су такође оцењени негативно, а ово је свакако значајно економичније од увећања зараде на нивоу за који би запослени рекли да их задовољава.

Потребно је да квалитетнију организацију пословања прати и оцењивање квалитета рада запослених и адекватно награђивање стручности у раду.

У погледу специфичност различитих категорија запослених, утврђено је да су жене склоније да прихвате оцену рада ако се при давању оцене у обзир узму и утисци самих пацијената, те да старији оптометристи више цене мишљење својих колега. Млађе колеге ће посебно ценити оне промене које допринесу повећању обима стручног рада.

Коначно, стручно усавршавање је препознато као изузетно важан елемент рада у специјализованој офталмолошкој болници и представља окосницу не само унапређења стручности кадра, већ и унапређења задовољства на радном месту.

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# CORRELATION BETWEEN PRESBYOPIA AND THE PATIENT'S AGE

Siniša Glavaš

*University of Novi Sad, Faculty of Sciences, Department of Physics, Optometry*

*E-mail: sinisaglavas@ymail.com*

## INTRODUCTION

Presbyopia (or age-related farsightedness), which results in the need for visual aid (glasses), is a consequence of elasticity loss not only in the lens of the eye, but the organism as a whole, and is caused by slight changes that accumulate as the years pass at an increasing pace. As the lens of the eye loses some of its elasticity, its ability to change shape and focus objects at different distances reduces. The elasticity loss is gradual and by the time we realize we have difficulties focusing on objects that are near, the lense of the eye has already lost a significant part of its ability to accommodate.

## 1. EYE ACCOMMODATION

Eye accommodation is the ability of the eye to clearly see objects at different distances, due to the refraction of light through the lens. A young eye with a natural lens goes through an increase in the optical power, with the ability to adapt to see near objects. This change is caused by an increase in the optical power of the crystalline lens due to a decrease in the diameter of the lens, an increase of the axial density of the lens and an increase in the curvature of the anterior and posterior surfaces of the lens.

The changes in the shape of the lens lead to a significant increase of its refractive power – for children aged around 8, this increase is up to 13-14 D. In this way, the lens increases its refractive power from +20 D (a state of disaccommodation – looking far), to +33D at the highest accommodation level when the object is 7-8 cm away from the eye. This is a typical description of the eye accommodation originating from Helmholtz dating back to the mid-19th century.

To understand the mechanisms of accommodation, it is important to understand the anatomy of the ocular structures involved in accommodation and their corelations. These structures are: ciliary body, ciliary muscle, anterior and posterior zonular fibers, lens capsules and lens substance.

Accomodation capacity is characterized by the scope and the width of the accommodation.

## 2. PRESBYOPIA

Presbyopia (age-related farsightedness) is a normal condition that is associated with the age in which the eye accommodation decreases, and its manifestations depend on the usual needs and the scope of reading. Its occurrence is caused by a physiological drop in the amplitude of accommodation, and it varies depending on the individual, their profession and their previous refractive error.

Presbiopia is clinically recognized after the age of 40. It occurs when the scope of the accommodation drops below 4 diopters.

There are several types of presbiopia:

1. Incipient presbyopia
2. Functional presbyopia
3. Absolute presbyopia
4. Premature presbyopia
5. Nocturnal presbyopia

### **3. CORRECTION (PRESCRIPTION) OF PRESBYOPIA**

One of the most important parts of the eye exam done by an optometrist or ophthalmologist is examining fundus oculi and measuring eye pressure.

There are several options for correcting presbyopia:

1. monofocal lenses
2. bifocal lenses
3. trifocal lenses
4. multifocal (progressive) lenses
5. contact lenses
6. accommodative lenses (in cataract surgery)

### **4. OBJECTIVE AND METHODOLOGY OF THIS PAPER**

In order to examine and test the frequency and the levels of presbyopia, measuring the amplitude of accommodation was used. Twenty patients took part in the research. The amplitude of accommodation was checked monocularly.

To determine the amplitude of accommodation, a long ruler and an optotype at near was used. In addition to the measurements of the amplitude of accommodation, the table shows the data obtained by measuring the distance and near visual acuity using a subjective method.

The results lead to understanding that the patients with presbyopia have around average amplitude of accommodation, meaning it decreased with age and no eye diseases were detected.

### **CONCLUSION**

Presbyopia, as a physiological disorder, needs to be corrected, as it can result in the diminished quality of life. Patients who come in the experts's office to have their vision checked, also have the opportunity to have their eye structures examined to discover possible pathological changes.

The average age of those first reporting symptoms of presbyopia is 42.

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# ПОВРЕДЕ ОКА

<sup>1</sup>Ана Жикић

<sup>1</sup>Природно-математички факултет, Универзитет у Новом Саду,  
Депарتمان за физику, Оптометрија

## УВОД

Орган вида је често предмет разних траума, било мирнодопских, било ратних. Поред чињенице да је око сразмерно веома мали део нашег тела, треба имати у виду и чињеницу да је око високодиференцирани део централног нервног система, те извесне повреде могу довести до ирверзибилних промена у погледу његове функције.

Неопходно је да се студенти оптометрије упознају са проблематиком трауматогије ока, јер од правилног указивања прве помоћи често зависи даља судбина повређеног органа вида.

Према врсти узрока повреде ока се деле на: механичке, физичке, хемијске.

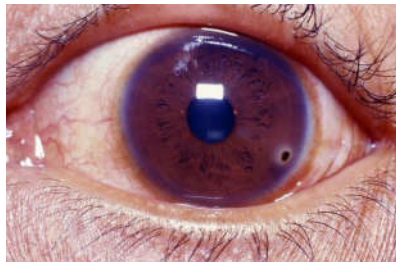
## 1. МЕХАНИЧКЕ ПОВРЕДЕ

У механичке повреде спадају: губитак епитела рожњаче, страни тело вежњаче горњег капка, страни тело рожњаче, контузионе и перфоративне повреде (са и без задржавања страног тела, као и симпатичка офталмија).

2.1. • Губитак епитела рожњаче. Своди се у ствари само на дефект епитела.

2.2. • Страно тело вежњаче горњег капка: У свакодневном животу (на радном месту или ван рада) може доћи до упадања страног тела, било које врсте. Оно се обично имплантира у субтарзални жљеб горњег капка, пошто је предходно доспео у конјуктивану врећицу.

2.3. • Страно тело рожњаче: слично као код ерозије рожњаче. Праћена блефароспазмом, фотофобилом, епифором, и цилијарном хиперемijом.



Слика 1. Страно тело рожњаче

2.4. • Контузионе повреде: тупа траума разних предмета.



Слика 2. Поткожни подлив доњег капка после контузионе повреде

2.5. • Перфоративне повреде: У ову групу спадају оне врсте повреда при којима је дошло до перфорације омотача очне јабучице (рожњаче или беоњаче). Могу бити изазване разним предметима.

## 2. ФИЗИЧКЕ И ХЕМИЈСКЕ ПОВРЕДЕ

•У физичке повреде спадају: опекотине и повреде изазване зрачењем (ултравиолетни и инфрацрвени зраци); а у хемијске повреде: повреде киселинама, базама и анилинским бојама.

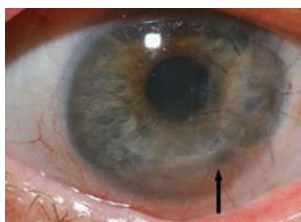
а. Опекотине су повреде изазване дејством термичких агенаса (гасовито, течно, чврсто).

Ултравиолетни зраци су зраци чија таласна дужина мања од видљивог зрачења (<400nm). Могу изазвати следећа обољења: кератоконјуктивитис, офталмиа..)

Инфрацрвени зраци обухватају електромагнетско зрачење с таласним дужинама већим од таласне дужине видљиве светлости а мањим од таласне дужине радио таласа. Могу својим дејством изазвати извесне патолошке промене на оку.

б. •Зависно од врсте хемијског средства које је допело у око хемијске повреде сврставамо у две групе: 1) повреде киселинама и 2) повреде базама. Заједнички пермин им је: каузома.

Повреде киселинама најчешће изазивају азотна ( $\text{HNO}_3$ ), сумпорна ( $\text{H}_2\text{SO}_4$ ) и сирћетна киселина ( $\text{CH}_3\text{COOH}$ ). Оне својим дејством доводе до коагулационе некрозе услед стварања ацидоалбумината који истовремено стварају и један заштитни слој који онемогућава даљи продор киселине у дубље слојеве ткива.



Слика 3. Каузома – повреда ока азотном киселином

Повреде базама најчешће изазивају гашени креч ( $\text{CaOH}_2$ ), амонијак ( $\text{NH}_4\text{OH}$ ) и камена сода ( $\text{NaOH}$ ). Ток хемијске повреде базама има тежи развој с обзиром да базе у контакту с ткивима продире у дубље слојеве ткива.

•Повреде анилинским бојама су повреде мастиљавом оловком. Карактеристична је плавољубичаста боја захваћених делова вежњаче које често убрзо показују знаке некрозе.

## 3. РАТНЕ ПОВРЕДЕ

Ратне повреде су узроковане експлозивним средствима, пројектилом из ручног ватреног оружја, тупином механичког тела, ударом ваздушног таласа, високом температуром, хемијским средствима, радијацијом, бљеском светлости при експлозији нуклеарне бомбе.

Ове повреде могу проузроковати најтежа оштећења ока и прогноза не зависи само од тежине повреде већ и од баговременог и правоног лечења.

Према узроку се деле на: механичке, физичке (термичке, радијационе, светлосне), хемијске и повреде настале услед удара ваздушног таласа.

## ЗАКЉУЧАК

Збрињавање повреда у миру које су нанете било случајно (у игри, спорту, на раду), било, пак, намерно, од стране других лица (најчешће у тучи или у рату, базира на истим принципима, али начин збрињавања треба прилагодити постојећим условима. Сем тога, лекар практичар мора познавати правила указивања прве помоћи при повредама органа вида приликом елементарних, масовних или саобраћајних несрећа.

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# ETIOLOGY OF RED EYE

Kubina Kitt<sup>1</sup>, Nataša Danilović<sup>2</sup>, Sava Barišić<sup>3</sup>

<sup>1,2,3</sup>*Department of Physics, Faculty of Sciences, University of Novi Sad, Serbia*

## INTRODUCTION




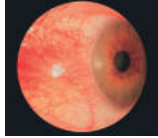


Red eye symptom can be caused by suffusion, mechanical causes, hyperemia or increased conjunctival vascularisation. Also, red eye can appear as consequence of infectious, chemical or allergic causes.

### 1. RED EYE - THE MOST COMMON CAUSES

The most common causes of red eye symptoms are: subconjunctival bleeding, conjunctivitis, uveitis, iridocyclitis, dry eye and contact lenses.

**Subconjunctival bleeding** occurs when small blood vessels burst under the tissue that covers sclera.

**Table 1.** Causes of red eye

<b>Subconjunctival bleeding</b>		<b>Episcleritis</b>	
<b>Hemosis of conjunctiva</b>		<b>Scleritis</b>	
<b>Conjunctivitis</b>		<b>Iridocyclitis</b>	

**Conjunctivitis** is inflammation that usually appears with symptoms such as eye tingle, pricking, itching, pain, etc. A diffuse edema appears with constant swelling of conjunctiva. The consequence is that conjunctiva is so swollen that it can even prevent the normal closing of the eye.

In **acute glaucoma**, episcleral veins are enlarged, the eyelids are swollen, sclera is hyperemic, the pupil is ovally dilated and does not respond to light. The cornea is blurred and high eye pressure is present. The intraocular eye pressure was so high that is not possible to measure.

**Uveitis** is inflammation of the whole middle layer of the eye, whereas **iridocyclitis** is the inflammation of its frontal part (iris and ciliary body). The eye can be permanently damaged.

**Dry eye syndrome** occurs when the cornea and the epithelium of conjunctiva are damaged. This condition and potential damage are caused by decreased moisture on the surface of the eye.

**Complications of contact lenses** are rare with RGP lenses. With the soft lenses complications are more frequent due to improper maintenance, caring or infection problems. It is very important that RGP lens is properly applied to avoid contact with conjunctive.

## 2. MATERIALS AND METHODS

For the purposes of this paper two hundred eyes (100 patients) were examined. The symptoms of red eye were present in 89 patients on both eyes. After taking anamnesis from the patient, the autokeratorefractometry and subjective refraction was performed for every patient. Biomicroscope examination was done at the end of the procedure.

## 3. RESULTS

The results show that improper wearing of contact lenses caused symptoms of red eye in 26 people. The most common cause was leaving contact lenses in the eyes too long. Also, these patients report improper cleaning, improper storage or not using appropriate contact lens solution.

According to the results, four groups of patients were formed. The first group consist of people between 15 and 25 years of age. In this group, most patients spend their time looking at near (reading, learning and using digital devices), so the common cause of red eye was hyperopia. The second group consists of people that are between 26 and 35 years of age. Many patients from this group wear glasses or contact lenses. There were problems related to refractive error such as: underestimated hyperopia, uncorrected hyperopia and overestimated myopia. Also, there were patients who wear inappropriate spectacles or contact lenses. Half of the examined patients in this group reported symptoms of digital eyestrain. In third group, there were patients between 36 and 45 years of age. Most of these patients had hypertonia. In the fourth group there were patients older than 45 years. Most common cause of red eye in these patients was uncorrected or underestimated presbyopia. These patients also reported symptoms of hypertension and diabetes.

## CONCLUSION

In conclusion, the majority of patients who were examined, had conjunctivitis. The major causes of this condition are: infection, allergic reaction and cosmetics. The second common cause of red eye symptom is improper use of contact lenses. Digital eyestrain also appears as frequent cause of red eye condition.

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# THE SIGNIFICANCE OF THE CORRECT FIT OF THE RGP CONTACT LENSES FOR VISUAL ACUITY

Authors: Livija Temunović<sup>1</sup>, Luka Kuburić<sup>2</sup>, Luka Vasiljević<sup>3</sup> i Mihail Zec Dodoš<sup>4</sup>

<sup>1,2,3,4</sup> Address: Faculty of Sciences, Novi Sad

## 1. INTRODUCTION

This study was performed to determine the influence of the RGP contact lens on visual acuity (VA) and how this visual sharpness changes with the change in the lens fits.

### 1.1 RGP contact lenses

RGP, or "rigid gas permeable lens", represents a hard, gas-permeable contact lens used as an optical aid in the correction of refractive anomalies such as myopia, hypermetropia, and astigmatism. [1]

They are characterized by high oxygen permeability, resistance to deposits, good maintenance of corneal metabolism, exceptional optical characteristics and sometimes the only solution for correcting the refractive error of the patient. [1]

### 1.2 Fitting the RGP lens

The term fitting implies the determination of a contact lens based on the topography of the cornea and the evaluation of the interaction of that contact lens with the cornea. A well-adjusted contact lens should be well centered on the eye, movable, comfortable and provide a satisfactory visual acuity (VA). [2]

With RGP lenses we have three main fitting philosophies: [3]

- A flatter fit
- Aligned fit and
- Steeper fit.

## 2. TESTING FITES OF RGP CONTACT LENSES BY BIOMICROSCOPY

Biomicroscope, i.e. the slit lamp is used for examination of the front segment of the eye, which is of great importance when it comes to fitting contact lenses. It consists of a relatively small microscope, through which an eye and a light source is illuminated that illuminates that eye. [4]

In our study we used a biomicroscope with a cobalt blue light and we watched our patients eye whit a hard contact lens on. On the eye we put fluorescein with which we could estimate the amount of tear lens that was between the contact lens and cornea and thus determine the quality of the lens fits.

Our patient wears the spectacular correction shown in Table 1. For the test fit, we used RGP contact lenses "OculoLens" produced by "OPTICUS" whose parameters are shown in Table 2.

Due to the small and negligible eye-correction on the left eye, in the following text, we will focus only on the right eye.

**Table 1.** Correction of the patient with glasses

	<i>Sph (D)</i>	<i>Cyl (D)</i>	<i>Axis (°)</i>
<i>O.D</i>	-0,5	-0,25	100
<i>O.S</i>	-0,25		

**Table 2.** Diameter and dioptric strength of test lens

<i>TD (mm)</i>	<i>BVP (D)</i>
9,3	-3,00

The curvature value of the cornea that is important to us for determining the appropriate trial curve lens is taken using the "WR-5100K, Grand Seiko Co." auto-ref / keratometer and is shown in Table 3.

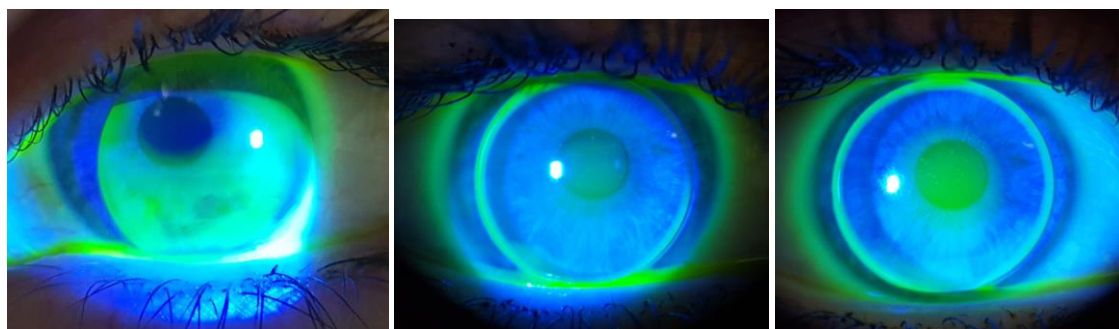
**Table 3.** Keratometry patient

	<i>R1 (mm)</i>	<i>Power (D)</i>	<i>Axis (°)</i>	<i>R2 (mm)</i>	<i>Power (D)</i>	<i>Axis (°)</i>
<i>O.D</i>	7,94	42,50	178	7,87	42,87	88
<i>O.S</i>	7,91	42,62	31	7,81	43,25	121

In Figure 1 (left) we see what the flat fit of the contact lens looks like on the patient's eye. It's used the base curvature lens is 7.9 mm and this is an inadequate fit.

In Figure 1 (in the middle), is shown an harmonized fit contact lens model. It is a base of 7.8 mm and It's a good fit.

Too steep fit is shown in Figure 1 (right). With a base curve of 7.7 mm and it is as such, unacceptable.



**Figure 1.** Loose fit (left), harmonized fit (middle), firm fit (right).

The change in the visual acuity of the patient with different lens fittings is shown in Table 4.

**Table 4.** Influence of the base curve of the lens on the visual acuity of the patient.

<i>BC (mm)</i>	<i>V.O.</i>
7.7	1.10
7.8	1.25
7.9	0.9

Generally speaking, it always goes on a level, i.e., milder meridian, but there are deviations and that is why it is very important to test lenses fit. In our case, the patient is comfortable with the lens comfort and visual acuity, though is fitted with a steeper base curve, as can be seen from Table 4.

All previously mentioned is done on the right eye.

### 3. KEYWORDS

RGP CL – rigid gas permeable lens

Proper fit – aligned fitting model

V.O. – Visual acuity

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# ZNAČAJNOST PRAVILNOG FITA RGP SOČIVA ZA VIDNU OŠTRINU

Authori: Livija Temunović<sup>1</sup>, Luka Kuburić<sup>2</sup>, Luka Vasiljević<sup>3</sup> i Mihail Zec Dodoš<sup>4</sup>

<sup>1,2,3,4</sup>Adresa: Prirodno-matematički fakultet u Novom Sadu

## 1. UVOD

Ovo istraživanje je rađeno kako bi se utvrdilo uticaj fita RGP kontaktnih sočiva na vidnu oštrinu i kako se ta vidna oštrina menja sa promenom fita sočiva.

### 1.1 RGP kontaktna sočiva

RGP, ili “rigid gas permeable lens”, predstavlja tvrdo, gas propusno kontaktno sočivo koje se koristi kao optičko pomagalo u korekciji refraktivne anomalije kao što je mijopija, hipermetropija i astigmatizam. [1]

Odlikuje ih visoka propustljivost kiseonika, otpornost na depozite, dobro održavanje metabolizma rožnjače, izuzetne optičke karakteristike i nekada jedino rešenje za korekciju refraktivne greške pacijenta. [1]

### 1.2 Fitovanje RGP sočiva

Pod pojmom fitovanje podrazumeva se određivanje kontaktnog sočiva na osnovu topografije rožnjače i procene interakcije tog kontaktnog sočiva sa rožnjačom. Dobro podešeno kontaktno sočivo treba da je dobro centrirano na oku, pokretljivo, udobno i obezbeđuje zadovoljavajuću oštrinu vida. [2]

Kod RGP sočiva imamo tri glavne filozofije fitovanja: [3]

- Ravniji fit,
- Poravnat fit i
- Strmiji fit.

## 2. ISPITIVANJE FITA RGP SOČIVA BIOMIKROSKOPOM

Biomikroskop, tj. slit lampa se koristi za ispitivanje prednjeg segmenta oka, što je od velikog značaja kada je u pitanju fitovanje kontaktnih sočiva. On se sastoji od mikroskopa relativno male jačine, kroz koji se posmatra oko i svetlosnog izvora koji osvetljava to oko. [4]

U našem istraživanju koristili smo biomikroskop sa kobalt plavim svetlom kojim smo posmatrali oko pacijenta koji nosi tvrdo kontaktno sočivo. Na oko smo stavljali fluorescein pomoću kojeg smo mogli da procenimo količinu suznog sočiva koje se nalazilo između kontaktnog sočiva i rožnjače i tako utvrdimo kvalitet fita sočiva.

Naš pacijent nosi naočalnu korekciju koja je prikazana u tabeli 1. Za probno fitovanje koristili smo RGP kontaktna sočiva “*OculoLens*” koje proizvodi “*OPTICUS*” čiji su parametri prikazani u tabeli 2.

S obzirom na malu i zanemarljivu naočalnu korekciju na levom oku u daljem tekstu ćemo se fokusirati samo na desno oko.

**Tabela 1.** Naočalna korekcija pacijenta

	<i>Sph (D)</i>	<i>Cyl (D)</i>	<i>Axis (°)</i>
<i>O.D</i>	-0,5	-0,25	100
<i>O.S</i>	-0,25		

**Tabela 2.** Dijametar i dioptrijska jačina probnog sočiva

<i>TD (mm)</i>	<i>BVP (D)</i>
9,3	-3,00

Vrednost zakrivljenosti rožnjače koja nam je bitna za određivanje odgovarajuće bazne krive probnog sočiva je uzeta pomoću “*WR-5100K, Grand Seiko Co.*” auto-ref/keratometra i prikazana je u tabeli 3.

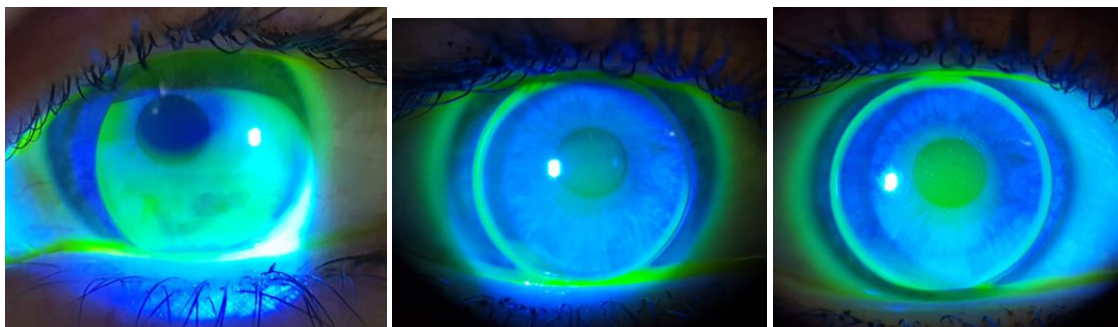
**Tabela 3.** Keratometrija pacijenta

	<i>R1 (mm)</i>	<i>Power (D)</i>	<i>Axis (°)</i>	<i>R2 (mm)</i>	<i>Power (D)</i>	<i>Axis (°)</i>
<i>O.D</i>	7,94	42,50	178	7,87	42,87	88
<i>O.S</i>	7,91	42,62	31	7,81	43,25	121

Na slici 1. (levo) vidimo kako izgleda ravniji fit kontaktnog sočiva na pacijentovom oku. Korišteno je sočivo bazne krivine 7,9 mm i ovo predstavlja neadekvatan fit.

Na slici 1. (u sredini) je prikazan usklađen model fita kontaktnog sočiva. On je baze 7,8 mm i predstavlja dobar fit.

Previše strm fit se vidi na slici 1. (desno). Sa baznom krivinom 7,7 mm i on je kao takav neprihvatljiv.



**Slika 1.** Labav fit (levo), usklađen fit (srednji), čvrst fit (desno).

Promena u vidnoj oštadini pacijenta kod različitih fitova sočiva prikazana je u tabeli 4.

**Tabela 4.** Uticaj bazne krive sočiva na vidnu oštrinu pacijenta.

<i>BC (mm)</i>	<i>V.O.</i>
7.7	1.10
7.8	1.25
7.9	0.9

Generalno gledano, uvek se ide na ravniji tj. blaži meridijan, ali postoje odstupanja i zato je veoma značajno fitovati probna sočiva. U našem slučaju, pacijent zadovoljan udobnošću sočiva i vidnom oštrinom iako je fitovan strmijom baznom krivinom, što se vidi iz tabele 4.

Sve predhodno navedeno rađeno na je na desnom oku.

### 3. KLJUČNE REČI

RGP CL – tvrdo, gas propusno kontaktno sočivo

Pravilan fit – poravnat model fita

V.O. – vidna oština

### 4. REFERENCE

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[4] Zoran Mijatović, Optički i optometrijski instrumenti, p. 50 (Univerzitet u Novom Sadu, 2009.)

# POSSIBILITIES TO FITTING SPHERICAL POWER EFFECT BITORIC RGP CONTACT LENSES

Nevena Popić, Jovana Sremac, Imre Gúth

University of Novi Sad, Faculty of Sciences, Department of Physics,  
Trg Dositeja Obradovica 4, Novi Sad, Serbia

## ABSTRACT

In this paper the possibilities of fitting spherical power effects bitoric (SPE) contact lenses (compensated bitoric) were examined in the area between the classic application of these lenses and spherical contact lenses. The starting point was the fitting of compensated bitorics in a flexible low toric approximation model. In this way by the created cylindrical tear lens the spectacle cylinder is completely compensated. The guidelines for fitting and empirical calculation of the parameters of a suitable correction lens are given in the paper.

**Keywords:** Spherical power effect bitoric contact lenses, SPE, Compensated bitoric, RGP lens fitting, Flexible LTA, Empirical fitting.

## 1. INTRODUCTION

Bitoric RGP contact lenses are used in many cases when the toric back surface/spherical front surface of the lens leads to an excessive amount of residual astigmatism. That can be corrected by the production of a cylindrical front surface also. The special form of these bitoric lenses is spherical power effect (SPE) bitoric (compensating bitoric). This lens has spherical power when it is on the eye, but it has a toric design. It can be understood as a lens which has a minus cylinder on the back surface and the same axis, but plus cylinder on the front surface. SPE is fitted in the conditions when the patient doesn't have a cylinder in the spectacles refraction ( $SA=0$ ), but the cornea has toric shape. As a rule, the compensation bitoric is fitted in FAM model (full alignment model), which means that the lens is full aligned with cornea and there is no cylindrical tear lens between the lens and the cornea. On the other hand RGP lenses are used in cases when spectacle cylinder ( $SA$ ) is approximately equal to corneal ( $CA$ ). In this paper the possibility of fitting the RGP lens for all other situations which lie between spherical lenses and compensating bitorics (SPE) will be considered.

## 2. RESULTS AND DISCUSSION

In classical fitting of the contact lenses with compensating bitoric, the full alignment model (FAM) is used. The back side of the lens is chosen so, that the steep and flat meridian is completely aligned with the surface of the cornea. The cylindrical power of the compensating bitoric is determined on the basis of the magic number: optical equivalent of the material which the lens is made of

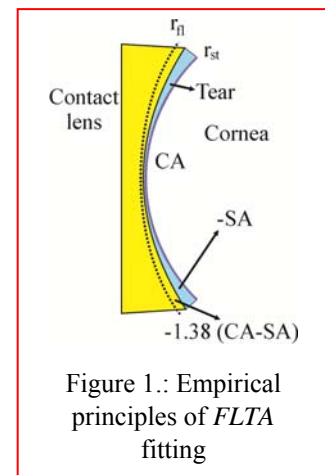
$$\zeta = \frac{n_{CL} - 1}{n_{Cor} - 1} = 1.38 \quad (1)$$

for the contact lens material of the refractive index  $n_{CL} = 1.467$ . So the cylinder of the compensating bitoric is empirically calculated as

$$Cyl = \zeta \cdot CA = 1.38 \cdot CA \quad (2)$$

where the absolute value of corneal astigmatism is marked with  $CA$ .

On the other hand, in the case of a low toric approximation (LTA) the steep meridian is fitted slightly more flattened than the cornea, so that the total astigmatism ( $SA$ ) of the eye is partially compensated by the created tear cylindrical lens. This has been inspired by the idea of using the model called Flexible LTA (*FLTA*), which can be apply in fitting of compensating bitoric. The basis is that the compensating



bitoric (SPE) which doesn't have cylindrical power, is fitted more flattened in a steep meridian. The request is that the induced cylindrical tear lens has the value of the total required cylinder (SA). In Picture 1. is this case schematically given. The surface of the cornea has toricity in the air +CA. Flat meridian of the lens is fitted aligned, while the curvature of the steep meridian is chosen that the induced tear lens (which has the back curve of the steep meridian of cornea) has spherical power of -SA (because a minus lens is created due to a flat fits). So the front of the tear lens has a total cylindrical power.

$$Cyl_{tearfilm\ surfaces} = CA - SA \quad (3)$$

This can be compensated by the cylinder of the same intensity and axis, but negative cylinder power. Here the field of possible application of *FLTA* is seen: it can be used in each cases when

$$CA > SA \quad (4)$$

Appropriate cylinder power of the back surface of SPE lens (that means the power of the lens in the "material", which has the same curve as the needed correction) can be easily calculated on the base of magic number and equation (2) as

$$Cyl_{CL} = -\zeta \cdot (CA - SA) \quad (5)$$

Because this cylinder is compensated from the front by a cylinder of the same axis, but with positive power, cylindrical correction at the end comes only from the created tear lens (Picture 1.)

Table 1: Parameters of empirical fitting with *FLTA*

Conditions: SA<CA
Lens: SPE Compensating bitoric
TD = available
BC = flat_K
BVP = Rx (Vertex correction)
Correction Cylinder: SA
Cylinder axis: flat_K
SPE CL Cylinder: 1.38 (CA-SA)

The basic parameters in empirical fitting of the compensating bitorics by the model *FLTA* can be seen in Table 1. The lens basic curve (BC) is chosen as a flat\_K, since the curve in a steep meridian is released from the cornea (known rule for LTA). The spherical power of the lens is taken as the subjective spectacle refraction corrected to the vertex distance. Achieved cylindric correction is SA, and the cylinder of the surface of the compensating bitoric lens is given by a relation (5).

## CONCLUSION

SPE bitoric contact lens in *FLTA* fitting model can be successfully used in cases that lie between the field of application of spherical RGP lenses (SA=CA) and the field of application of the aligned compensating bitorics (aligned-SPE) (SA=0). Due to its design and absent of cylindrical optical power, SPE is the ideal solution to the problem in case when SA is between the values 0 and CA. In other words *FLTA* fitting of the spherical power effect bitorics can be applied to cases CA>SA. On the other hand the flexible fitting of SPE allows better movement of the contact lens and thus a better exchange of tears from the standard FAM model. Correction with *FLTA* provides full correction without any residual cylinder using a relatively standard and accessible contact lenses.

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# FUSIONAL VERGENCE

Dejan Popović<sup>1</sup>, Nataša Danilović<sup>2</sup>, Sava Barišić<sup>3</sup>

*Department of Physics, Faculty of Sciences, University of Novi Sad*

## INTRODUCTION

Fusion is one of the three elements of binocular vision. Fusional reserves (FR) are the measure of fusion reflex needed to overcome phorias. It is measured in the prism necessary for its break-down and perception of double vision. For normal healthy eye, it is necessary that at least 1/3 of fusional reserves are available all time. Measurements are carried out at distance and at near. We also measure vertical and horizontal fusional reserves. As for both vertical and horizontal there are positive and negative values. When we measure vertical, we use prism base up and prism base down, and for the horizontal we use the base out and the base in. The base out stimulates convergence, and the value required for producing diplopia is positive (PFR). The base in stimulates divergence and the value required for diplopia is negative FR (NFR).

## 1. PROCEDURE

Measurements are performed by slight increases in prism values under binocular viewing conditions. This prism increase will cause certain points which the patient should report to us. Those points are: *blur point*, *break point*, *recovery point*. Normal values for horizontal FR are (in prism D): distance positive 12-16 / 18-22 / 14-18, and for distance negative - / 6-12 / 4-8, near positive 20-28 / 26-34 / 22-30, near negative 6-10 / 12-18 / 8-14. And values for vertical are for distance and near: - / 4-6 / 2-4 [1]. Measuring FR can be done by using *phoropter* or *prism bar*. In this examination prism bar was used. At the beginning of the procedure it is explained to the patient what will be done during the test. The patient should wear their distance refractive corrections. Position yourself in front to see the patient's eyes without obstructing. Ask a patient to fixate the letter that is one row above than the best visual acuity.

### 1.1. HORIZONTAL FUSIONAL RESERVES

First measure horizontal fusional reserves for near and then for distance. Increase prism value gradually until the patient reports *blur point*. Stop measurements and ask the patient to attempt to clear the letters. If letters can be cleared continue to increase prism. If letters cannot be cleared, that means that the *blur point* is reached (in some situations there will not be blur point). Continue to increase prism until patient reports double vision. This means that *break point* is achieved. In this point eyes can no longer make motor response to overcome the prism power and visual axes are no longer in alignment [2]. After *break point* slowly reduce the prism until patient reports that two images become single image again. That is *recovery point*.

### 1.2. VERTICAL FUSIONAL RESERVES

After horizontal measurements are done, next step is to measure vertical FR. When measurements for vertical FR are performed, *blur point* will not appear. Put the prism bar in front of one eye and gradually increase prism value until a patient reports double image (*break point*). After a patient reports double image start decreasing prism values until the patient reports recovery of image (two images forming a single image). Repeat measurements with prism base down/up depending on which one you measured first.

### **1.3 COMMON ERRORS**

During this test, examiner can make some common mistakes which are: expecting a *blur point* when measuring vertical fusional reserves, carrying out the test in those patients who do not have binocular vision at the test distance, providing an inappropriate stimulus to accommodation through poor choice of target and attempting to assess fusion reserves in young children when other (quicker) tests are available to assess motor fusion.

## **2. RESULTS**

The tests were performed on twenty subjects that are emmetropes (+0.50 / -0.50). The gender structure was mixed, from 20 subjects 6 of them were men and the rest of them were women with average age of 23.5 years. The test optotype and prism bar were used. Prior the testing for FR, a complete correction of refractive errors was made. Measurements were made for both horizontal and vertical FR. A patient with the highest readings was (M, 20) horizontal positive distance 16-35-20 and horizontal positive near 16-35-18. In some situations, *blur point* was not found for horizontal FR. One of the patients showed very low FR for horizontal values (M, 22) horizontal positive distance 8-14-6, and horizontal positive near 4-18-12, but in vertical measurements were within normal values.

## **3. CONCLUSION**

Results gave us values similar to the ones find in the literature [1], there were some lower values, and some a little bit higher. We therefore can conclude that refractive errors of lesser degree do significantly influence the FR values.

### **Appreciation**

I would like to thank Optica Yason for allowing me to carry out measurements needed for this paper.

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# APPLICATION OF CORNEAL TOPOGRAPHY

Stefan Radumilo, Imre Gúth

*University of Novi Sad, Faculty of Sciences, Department of Physics,  
Trg Dositeja Obradovica 4, Novi Sad, Serbia*

## ABSTRACT

Corneal topography is an indispensable part of the modern optometric examination of frontal eye segment. The amount of data obtained is a key factor in the development of topography and today it is almost unthinkable the functioning of ophthalmologic-optometric practice without the use of a corneal topograph. In this paper an overview of the basics of corneal topography was performed, with the use of the corneal topographer in optometry, and especially when fitting contact lenses.

**Keywords:** Corneal Topography, Topograph, Keratometry map, Pahimetry map.

## 1. INTRODUCTION

Corneal topography is a modern technique used in ophthalmology and optometry for medical recording and mapping of the front surface of the eye, therefore, detailed topographical description of the different curves and shapes of the cornea is provided. Corneal topography uses placido disc reflection, scanning slit and Scheimpflug photography and due to these three principles corneal topographers provide with high quality images. This method of examination has started back in the early 80's and is continuing to develop ever since. Newer generations of devices are based on the elevation system and provide the possibility of testing both front and rear surface of the cornea. With examination of both surface of the cornea, corneal topographers can detect early stages of corneal abnormalities such as keratoconus, pellucid marginal degeneration and other. Corneal topography is used in modern ophthalmology and optometry for: cataract surgery, keratoplastic surgery, refractive surgery, post-lasik examination, contact lens fitting, Pahimetry, determine the visual performance of the cornea.

## 2. EXPERIMENTAL

For the recording the topography of anterior eye Bausch and Lomb Orbscan II is used. The analysis of the results of the examiner was done on the software of the device itself. In the subjects, the values of curvature of the cornea, its elevation at different distances from the apex were determined, as well as data on the thickness of the cornea, calculation of best fit sphere, front chamber depth and other parameters.

## 3. RESULTS AND DISCUSSION

Figure 1 shows the topography of the subject 1. done with Bausch and Lomb topographers Orbscan II. In the topographic view window can be seen:

1. Anterior elevation map (Upper left corner)– The anterior best fit sphere (BFS) is calculated to best match the anterior corneal surface. The elevation BFS map subtracts the calculated BFS from the eye surface elevation in millimeters. The difference between the sphere and eye surface is expressed in radial distance from the center of the sphere. Green is “sea level” (match with a sphere that best matches the cornea). Warmer colors are above sea level, while cooler colors are below sea level.

2. Posterior elevation map (Upper right corner on Fig. 1.) describes the back surface of the cornea in the same manner as the anterior map but using posterior corneal measurements.

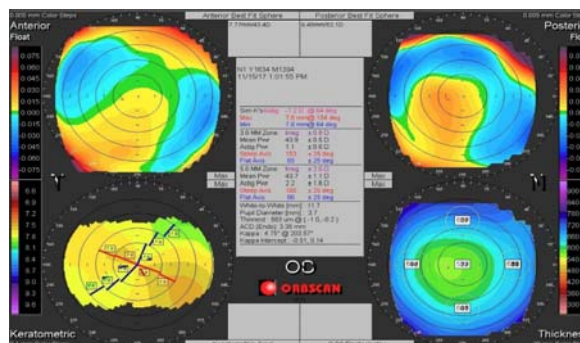


Figure 1: Corneal topographer maps, respondent no. 1.

3. Keratometry map (Lower left corner) – The keratometric map displays the refractive power of the anterior surface of the cornea and translates anterior curvature into corneal power.

4. Pahimetry map (Lower right corner)– The pahimetry map shows the corneal thickness through the entire cornea as well as the thinnest point of the cornea. Warm colors indicate thinner cornea while cooler colors indicate thicker corneas.

5. Statistics and data chart (In the center): identification of the patient, date and time of the performed measurement, simulated keratometric measurements, anterior chamber depth, 3mm and 5mm irregularities, kappa angle and other measurements.

The corneal topographic maps use color scales (Figure 2.) to illustrate the given measurements. Areas of steeper curvature, higher elevations and thinner corneas are shown in warmer colors such as red and orange, while the areas of flatter curvature, less elevations and thicker corneas are shown in colder colors such as green and blue. These color scales are displayed on the left and right margins of the data map with the lowest values at the bottom and the highest at the top. Values are expressed in diopteries, millimeters, microns.


MAP	BFS - Elevation	Keratometry	Pahimetry
Gradation	0.005 mm	0.1 mm	20 $\mu$
Trend	Elevation	Steep	Thin
	>30 to 80	5.63 – 7.14	200 to 400
	20 to 30	7.15 – 7.34	460 to 480
	10 to 15	7.35 – 7.83	500 $\mu$
	$\pm 5$	7.84 – 8.07	520 to 640
Trend	Depression	Flat	Thick

Figure 2. Gradient color scales

The analysis of the corneal topography maps gives a lot of data on the front segment of the examinee. All topographic maps require correct interpretation. Properly interpreting all the maps individually allows the selection the appropriate map for any situation that is related to each patient individually. The anterior elevation (Figure 1.) is shown in relation to the best fitted sphere, which is 7.77mm or 43.4D. The anterior elevation maps correspond to a model that represents the model of an incomplete central bridge. The posterior elevation is shown in relation to the best fitted sphere, which is 6.48mm or 52.1D. The posterior elevation maps correspond to the model of the peninsula. On the map of keratometry the keratometric values can be found for the steepest axis which is 7.6mm in 154° and the flat axis 7.8 mm in 64°. From the shape of the map of the keratometry can be said that this is the case of a symmetrical butterfly wings that is skewed due to a oblique astigmatism. The irregularities that follow the zone in 3mm are the mean power of the cornea, which is 43.9D and the astigmatism is 1.1D in 65°. The irregularities that follow the zone in 5mm are the mean power of the cornea, which is 43.7D and the astigmatism is 2.2D at 66°. On the map of pahimetry it is visible the case of a thicker cornea. The central thickness is 563 $\mu$ m. The cornea has a normal thickening going to the periphery. The diameter of the cornea is normal and in this case it is 11.7mm. The size of the pupil at the time of measurement was 3.7mm and this is the case of a narrow pupil. The depth of the front chamber is 3.35mm and this is considered as an average value.

#### 4. CONCLUSION

Based on several topographic analyzes and interpretation of results, it can be concluded that all subjects have normal values of topographic parameters, with fewer variations in individual parameters. The minor deviations to be considered are higher values of astigmatism and thickness of the cornea in the respondents 1, then the shallower front eye chamber in the subjects 2 and 3. In the respondent 3, the keratometric data is showing the spherical cornea, which should be considered for possible use of contact lenses.

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