



ORIGINAL ARTICLE

Prevalence of Keratoconus in Candidates for Refractive Surgical Procedures

ABSTRACT

Introduction. Keratoconus is the most common primary ectasia and has a significant effect on visual acuity and the quality of life. The prevalence of keratoconus in the general population of Bosnia & Herzegovina, and Croatia remains unknown. This study was designed to show the incidence of keratoconus in candidates for Excimer laser refractive surgical procedures in our eye clinics.

Methods. We analyzed preoperative examination data from 2,714 patients, collected over a two year period, who were candidates for Excimer refractive surgical procedures. Patients were sorted into groups according to their gender, age, degree of keratoconus (Amsler-Krumeich classification) and involvement of one or both eyes.

Results. Keratoconus was detected in 231 patients (335 eyes); 133 of the patients were male and 99 were female. Unilateral keratoconus was found in 127, and bilateral in 104 patients. Four age groups were designated: 49 were 18 - 25 years old, 68 patients were 25 - 35 years old, and 57 were in both age groups, 36 - 45 and 45 -75 years. Keratoconus was diagnosed in 335 eyes with the following distribution: stage I – 86, stage II – 84, stage III – 97, and stage IV – 68 eyes.

Conclusion. We examined a large number of patients preoperatively and found a higher prevalence of keratoconus than previously reported for the general population. Our particular sample does not accurately reflect the prevalence of the disorder within the general regional population of Bosnia & Herzegovina, and Croatia. Nonetheless, our findings signal a need for public health outreach and intervention for keratoconus within those regions.

KEY WORDS

keratoconus, unilateral, bilateral, gender, Allegretto Oculyzer.

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Keratoconus is the most common primary ectasia occurring in the second decade of life that affects both genders. It is a degenerative disorder characterized by stromal thinning, which results in conical ectasia followed by an irregular astigmatism and loss of visual acuity. The early changes generally go unnoticed unless corneal topography is performed. Ectasia usually develops during puberty and continues with a slow progression into adulthood, mainly because free radicals decrease in the cornea after the age of 18, and there is a higher degree of corneal collagen cross-linking that normally occurs with aging.^{1,2} In most cases, both eyes are affected at the same time, but sometimes the process is unilateral. Contact lenses are the best solution for correcting refractive errors and preventing further

development of amblyopia. Severe cases are treated by corneal transplantation.

Genetic, biochemical and biomechanical causes of keratoconus have been suggested, but the ultimate mechanism probably involves a complex interaction of genetic and environmental factors.^{3,4} Family history, male gender and atopy are significant predictors. However, there is strong association between keratoconus and various immune conditions, including rheumatoid arthritis ulcerative colitis, autoimmune chronic active hepatitis, Hashimoto thyroiditis, arthropathy, and asthma.⁵

The estimated prevalence of keratoconus in the general population is 54 per 100,000.⁶ The overall incidence of this

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condition in the general population of Bosnia and Croatia is not known, although in 153 children with Downs syndrome in Croatia it was reported to be 1.3%.⁷

We evaluated the prevalence of keratoconus among patients who were candidates for Excimer laser refractive surgical procedures in order to determine if the patients are suitable for surgery.

Materials and Methods

We evaluated preoperative information from 2,714 patients (1,546 male, 1168 female) who were candidates for Excimer laser refractive surgical procedures at the Eye Clinic “Svjetlost” Zagreb, Croatia and Eye Clinic “Svjetlost” Banja Luka. Data were collected over the period from April 2007 until August 2009.

Every candidate for refractive surgery underwent an initial corneal topography examination with a WaveLight Allegretto Oculyzer (Alcon Laboratories, Inc.). The WaveLight Oculyzer is currently the most sophisticated diagnostic tool for pre-refractive surgery evaluation. It works on the basis of Scheimpflug principle, where a static camera evaluates pupil diameter and its position, while another camera rotates 360° around the eye to capture more than 50 images and more than 250.000 points of elevation on the cornea. In addition to elevation, this diagnostic tool indicates keratometry values, depth of the anterior chamber, pachimetry, coherent tomography of the crystalline lens and the degree of the iris-corneal angle aperture.

After the initial corneal topography, we evaluated uncorrected visual acuity (UCVA) and best spectacle corrected visual acuity (BSCVA) using refractometry results (as measured with a Topcon RM A7000B Auto-Keratometer). We also measured tear level by the Schirmer Tear Test method, and we assessed intraocular pressure (IOP) with noncontact tonometry (Reichert 7 Auto Tonometry). Finally, we used a slit lamp (CSO SL-980) to examine anterior and posterior eye segments.

Patients (231 out of the original 2,714) who were diagnosed with keratoconus were grouped according to gender, age, degree of keratoconus (Amsler-Krumeich classification), and number of eyes affected (bilateral or unilateral keratoconus). This study was approved by the Institutional Ethical Committee.

Results

Keratoconus was detected in 231 patients (335 eyes); it was equally distributed among genders: 132 male (53%) and 99 female (47%) patients. Unilateral keratoconus was found in 127 patients, and 104 cases were diagnosed as bilateral. The accompanying table shows that keratoconus was more prevalent within the second youngest age group (26 to 35 years old). In our sample of 335 eyes, the stages of kerato-

Keratoconus distribution as to age and gender

Age of patients (years)	No. of patients with keratoconus (any stage, unilateral or bilateral)		
	Male	Female	Total
18-25	32	17	49
26-35	40	28	68
36-45	31	26	57
46-68	29	28	57
Total	132	99	231

conus were distributed as follows: stage I – 86, stage II – 84, stage III – 97, and stage IV – 68 eyes.

Discussion

We find the prevalence of keratoconus among 2,714 candidates for Excimer laser refractive surgical procedures to be 8.5%. This is much greater than the estimated prevalence in the general population (6.8 - 54 per 100,000^{6,8}). Perhaps the higher prevalence of keratoconus in our patient population stems from the fact that the patients we included in the study had already sought treatment for their vision problems caused by this corneal disease. In other words, we had a concentrated and highly selected sample.

Of the initial cohort (2,714 patients) slightly more men (57%) than women (43%) sought the refractive surgical procedure, suggesting that men might be more aware of their visual problems than women. However, we found no gender difference in the incidence of keratoconus. Other reports indicate that the gender difference could be different among various nations.^{8,9}

The fact that unilateral keratoconus was detected in more than half (127) of the 231 patients diagnosed with the disease suggests that it was their refractive visual problems that brought them to the clinic for surgical correction. In the majority of these cases, the fellow eye had not developed corneal ectasia at the time of examination. Unilateral keratoconus may be permanent in some cases, but the incidence of unilateral keratoconus in the general population worldwide is much lower than in our particular patient population. The highest unilateral keratoconus was reported in Macedonia (16%).⁸

The extent of ectasia was, in some cases, more severe in the older group of patients. A similar pattern for age distribution was described by Assiri and colleagues.¹⁰ Some of our patients had waited too long to achieve correction of their vision. For these advanced cases, the only solution to restore visual acuity was corneal transplantation.

We acknowledge that our study involving a large group of selected patients—those who seek refractive surgical procedures for restoration of vision—is not representative of

the general populations of Bosnia and Croatia. Nonetheless, the results of this study signal a need for public health outreach and timely intervention for keratoconus.

Author contributions

BK had full access to all data in the study and as corresponding author takes full responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: BK, MB, NG, RK. Acquisition of data: BK, IK, EP, MB. Analysis and interpretation of data: BK, MB, EP, IK. Drafting of the manuscript: BK, MB. Critical revision of the manuscript: RK, NG. Statistical expertise: BK, MB, EP. Obtained funding: BK, RK, NG. Administrative, technical, or material support: BK, RK, NG. Study supervision: BK, RK, NG.

Conflicts of interest

No potential conflicts of interest relevant to this article was reported.

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Prevalencija keratokonusa kod kandidata za refraktivne hirurške procedure

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APSTRAKT

Uvod. Keratokonus je najčešća primarna ektazija koja ima važan uticaj na vidnu oštrinu i kvalitet života. Prevalencija keratokonusa među opštom populacijom u Bosni i Hercegovini i Hrvatskoj i dalje ostaje nepoznata. Cilj ove studije je da pokaže incidenciju keratokonusa kod kandidata za Excimer laser refraktivne hirurške procedure u našim oftalmološkim klinikama.

Metode. Analizirali smo preoperativne nalaze 2.714 pacijenata, prikupljene u toku dvije godine, koji su bili kandidati za Excimer laser refraktivne hirurške procedure. Pacijenti su grupisani prema polu, dobu, stepenu keratokonusa (Amsler-Krumeich klasifikacija) i prema keratokonus na jednom ili oba oka.

Rezultati. Keratokonus je otkriven kod 231 pacijenta (335 očiju); 133 pacijenta su bili muškarci i 99 žene. Unilateralni keratokonus je otkriven kod 127 pacijenta, a bilateralni kod 104. Pacijenti sa keratonusom podijeljeni su u četiri grupe: 49 su bili u dobi od 18 do 25 godina, 68 u dobi od 25 do 35 godina, a 57 u dobnim grupama od 36 do 45 i 45-75 godina. Keratokonus je dijagnostikovao kod 335 očiju sa sljedećom distribucijom: stadijum I-86 očiju, stadijum II-84, stadijum III-97 i stadijum IV-68 očiju.

Zaključak. Među preoperativnim pacijentima, nađen je veći stepen prevalencije keratokonusa nego u opštoj populaciji kako je to opisano u publikovanom saopštenjima. Naš rad ne predstavlja prevalencu među opštom populacijom Bosne i Hercegovine i Hrvatske, ali naši rezultati ukazuju na potrebu za širom zdravstvenom raspravom i reakcijom na visok nivo keratokonusa u istraživanom području.

KLJUČNE RIJEČI

keratokonus, unilateralni, bilateralni, pol, Allegretto Oculyzer.