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# Contact Lenses as the best Conservative Treatment of Newly Diagnosed Keratoconus – Epidemiological Retrospective Study

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## ABSTRACT

*Keratoconus is a progressive, non-inflammatory corneal ectasia characterized by thinning and weakening of the corneal stroma which results in its protrusion. The onset is during puberty and progresses until the fourth decade of life. In earlier stages, good visual acuity can be provided with spectacles. With progression, contact lenses are considered to be a better therapy. Aim of this study was to determine if there is statistically significant difference between best corrected visual acuity (BCVA) obtained by spectacles and contact lenses in newly diagnosed keratoconus patients, as well as to determine which type of contact lenses provide better BCVA in keratoconus patients. We conducted a 5-year retrospective study of all 2891 patients attending our Contact Lens Department for the first time, searching for patients newly diagnosed with keratoconus. Data were obtained on gender, age, education level, treated eyes, corneal changes, keratoconus severity, BCVA with spectacles, contact lenses and best fitted contact lens type. All patients underwent standard ophthalmic exam, refractometry and keratometry have been done, followed by a spectacles correction and lens fitting. Wilcoxon signed rank test was used for statistical analysis. Results showed that of all 2891 patients examined for the first time, 137 patients (4.74%) have been newly diagnosed with keratoconus, there was male bias (72.26%), mean age 27.7±9.9 years. Most patients had high school education (51.11%), 3.70% had present corneal changes, 50.37% had mild keratoconus. Majority had keratoconus on both eyes (36.3%) or keratoconus of right eye (26.67%). There was a statistically significant difference ( $p<0.001$ ) between the BCVA obtained with contact lenses ( $0.82\pm 0.21$  Snellen chart) rather than spectacles ( $0.37\pm 0.27$  Snellen chart). The best corrected visual acuity was achieved with rigid gas permeable (RGP) lenses in majority of keratoconus eyes (51.85%), with semi-gas permeable (SGP) lenses in 43.39%, in 4.23% with polymethyl methacrylate (PMMA) lenses and with hard-soft gas permeable (GP) contact lenses in 0.53% of keratoconus eyes. We have showed that there is a statistically significant difference in BCVA achieved better with contact lenses than with spectacles. RGP lenses are most frequently used in conservative treatment of keratoconus, but SGP lenses were also shown to be a good option that gives equally satisfying final visual acuity with subjective comfortable feeling of contact lens wear.*

**Key words:** keratoconus, retrospective study, spectacles, contact lenses, visual acuity, cornea

## Introduction

Keratoconus is a chronic, progressive, bilateral, non-inflammatory corneal ectasia characterized by thinning and weakening of the corneal stroma which results in its protrusion<sup>1-4</sup>. This condition predominantly affects the inferior-paracentral two-thirds of the cornea, which over time progressively steepens, exhibiting a more conical profile, resulting in myopia, irregular astigmatism and marked visual impairment<sup>1,5,6</sup>. The onset of keratoconus is usually during puberty and in many cases progresses until the third to fourth decade of life<sup>7-10</sup>. Most cases of this

condition appear sporadic, but according to some previous researches, a genetic factor may be involved<sup>11,12</sup>. The most common clinical signs of keratoconus are „oil droplet“ reflex when examining with direct ophthalmoscopy, Vogt striae, Fleischer ring and Munson sign. Its severity is graded according to the keratometry values into mild (<48D), moderate (48–54D) and severe (>54D)<sup>3</sup>. In the earlier stages, good visual acuity can be provided with spectacles. With the progression of the condition, contact lenses are considered to be a better therapy. Collagen

cross-linking and intracorneal ring segment implantation are also useful. In advanced cases, there is a need for surgical treatment such as keratoplasty. In Croatia, long term supply of contact lenses for keratoconic patients is provided by Croatian Health Insurance Fund. Our aim in this study was to see if there is a statistically significant difference between the best corrected visual acuity (BCVA) obtained by spectacles and contact lenses in newly diagnosed keratoconus patients as well as to determine which type of contact lenses provides better BCVA in keratoconus patients.

**Patients and Methods**

We conducted a retrospective study by reviewing the hospital records of all patients attending the Contact Lens Department from 1<sup>st</sup> January 2008 till 31<sup>st</sup> December 2012 for the first time, and who have been newly diagnosed with keratoconus. Data were obtained on gender, age at the time of first referral, education level, treated eyes, present corneal changes, degree of keratoconus, BCVA with spectacles, final BCVA after fitting and best fitted contact lens type after initial referral. Inclusion criteria were patients administered at our Clinic who were newly diagnosed with keratoconus. Non-inclusion criteria: poor VA, present corneal changes that refer to a possibly earlier not recognised keratoconus. Exclusion criteria: lack of data (1 patient), decompensated keratoconus (1 patient who was immediately referred for a keratoplasty). All patients underwent standard ophthalmic exam that included patients’ history, family history and permanent therapy, visual acuity test (Snellen chart), bulbomotrics, pupillary reactions, slit lamp test, tonometry, funduscopy. Refractometry and keratometry on Righton Speedy K keratorefractometer have been done followed by a spectacles correction and afterwards lens fitting. For a statistical analysis we used Wilcoxon signed rank test.

**Results**

Between the period of 1<sup>st</sup> January 2008, till 31<sup>st</sup> December 2012, 2891 patients has been administered to our Clinic for the first time. 137 out of 2891 patients were diagnosed with keratoconus (4.74%). The majority of patients were male (99 patients, 72.26%). One patient did not have all data in the records and one had corneal hydrops so they were excluded from further statistical analyses. The mean age of the patients at first examination was 27.7±9.9 years. Considering education level, 25 patients were in elementary or high school (18.52%), 16 were college students (11.85%), 4 patients had only elementary school education (2.96%), 69 patients had high school education (51.11%), 16 had academic degree (11.85%), and 5 patients didn’t state their education level (3.70%). Considering the severity of keratoconus measured with keratometry in diopters (D), patients were divided into 3 groups. First group was mild keratoconus, with keratometry values less than 48D in 68 patients (50.37%). Second group

was moderate keratoconus, with keratometry values between 48 and 54D in 49 patients (36.29%). The third group consisted of 18 patients (13.33%) with severe keratoconus, keratometry values more than 54D. Slit lamp biomicroscopy revealed that only 5 out of 135 patients (3.70%) had present corneal changes. One patient had incipient ectasia on both corneas, one had central macula on the right, one central macula on the left eye, and two patients had central maculae on both eyes. Considering the exact diagnosis, 135 out of 2891 patients (4.74%), altogether 189 out of 5782 eyes (3.27%) were diagnosed with keratoconus. Majority of patients had bilateral keratoconus (36.3%), followed by keratoconus of the right eye (26.67%), the least had incipient keratoconus of the left eye (0.06%) (Table 1).

**TABLE 1**  
TYPE OF NEWLY DIAGNOSED KERATOCONUS

Keratoconus	Patients
Right eye	36
Left eye	23
Both eyes	49
Incipient – right eye	10
Incipient – left eye	8
Incipient – both eyes	9
Total	135

The average BCVA of the right eye with spectacles was 0.34±0.27, and the BCVA of the left eye with spectacles 0.39±0.27 Snellen chart. There was a statistically significant difference (p<0.001) when comparing these to BCVA with contact lenses on the right (0.80±0.19), and on the left eye (0.84±0.22 Snellen chart), in favour of contact lenses (Figure 1). The best corrected visual acuity was achieved with RGP (rigid-gas permeable) lenses in majority of keratoconus eyes (51.85%), with SGP (semi-gas permeable) lenses in 43.39%, in 4.23% with PMMA (poly-methyl methacrylate) lenses and with hard-soft GP (gas permeable) contact lenses in 0.53% of keratoconus eyes (Table 2).

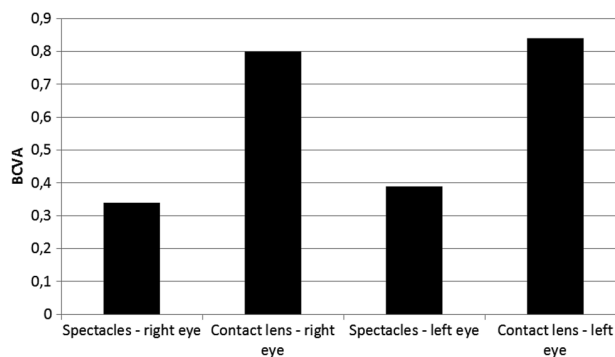


Fig. 1. Best corrected visual acuity (Snellen chart) with spectacles and with contact lenses.

**TABLE 2**  
CONTACT LENS TYPE THAT PROVIDED BCVA IN  
KERATOCONUS EYES

Contact lens type	Number of treated eyes
RGP	98
PMMA	8
SGP	82
Hard-soft GP	1
Total	189

## Discussion

During the 5 year period, 1 in 21 patients who were examined for the first time at our Clinic has been diagnosed with keratoconus. Our results indicate that keratoconus is a condition which most commonly affects male and that the right eye often can be first affected. According to some other authors, typical onset of keratoconus is during puberty and progresses until third or fourth decade of life<sup>7–10</sup>. Our results indicate that, as the condition slowly alters, patients do not usually come at the onset of this condition, rather at the time when spectacles no longer provide the best possible correction. That would explain

average age in the late twenties at the time of first examination at our Clinic. Although a satisfactory visual acuity can be achieved with more different lens type<sup>13</sup>, some authors claim RGP lenses have been the main treatment of keratoconus<sup>2</sup>. Our results showed that the best corrected visual acuity is also accomplished with RGP contact lenses, but that a great number of patients can also achieve satisfactory visual acuity with SGP contact lenses.

## Conclusion

Keratoconus is a progressive, ectatic disorder of the cornea which is characterized by corneal protrusion, stromal thinning, irregular corneal astigmatism and variable degrees of corneal scarring, altogether resulting in poor visual acuity of the affected eye. In the earliest stages patients may achieve satisfactory visual acuity using spectacles, however, as the corneal surface becomes more distorted, spectacles correction becomes progressively unsuccessful. We have showed that there is a statistically significant difference in BCVA achieved better with contact lenses than with spectacles. RGP lenses are most frequently used in conservative treatment of keratoconus, but SGP lenses are also a good option that gives equally satisfying final visual acuity.

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## KONTAKTNE LEĆE KAO NAJBOLJI IZBOR U KONZERVATIVNOM LIJEČENJU KERATOKONUSA – EPIDEMIOLOŠKA RETROSPEKTIVNA STUDIJA

### SAŽETAK

Keratokonus je progresivna, neupalna ektazija rožnice, karakterizirana stanjivanjem i oslabljenjem strome rezultirajući protruzijom rožnice. Tipično se pojavljuje u doba puberteta i napreduje do četvrtog desetljeća života. U ranim stadijima, dobra vidna oštrina postiže se korekcijom naočalama, a progresijom bolesti kontaktne leće pokazale su se boljom terapijom. Cilj ovog istraživanja je odrediti postoji li statistički značajna razlika u najboljoj korigiranoj vidnoj oštrini između naočala i kontaktnih leća, te s kojom vrstom leća u pacijenata s keratokonusom postizemo najbolju vidnu oštrinu. Proveli smo petogodišnju retrospektivnu studiju svih 2891 novopregledanih pacijenata u Kabinetu za leće, tražeći pacijente s novodijagnosticiranim keratokonusom. Obrađivali smo podatke vezano uz spol, dob, stručnu

spremu, tretirane oči, vidljive promjene rožnice, težinu keratokonusa, najbolju korigiranu vidnu oštrinu s naočalama, kontaktnim lećama i tip kontaktnih leća s kojima je takva vidna oštrina postignuta. Svi pacijenti prošli su standardni oftalmološki pregled, učinjene su refraktometrija i keratometrija, korekcija naočalama i kontaktnim lećama. U statističkoj analizi koristili smo Wilcoxonov test ekvivalentnih nizova. U rezultatima smo pokazali da je kod 4,74% pacijenata (137 od 2891) koji su prvi puta pregledani u Kabinetu za leće dijagnosticiran keratokonus. 72,26% pacijenata su bili muškarci, prosječna životna dob pacijenata  $27,7 \pm 9,9$  godina. Većina pacijenata (51,11%) imala je srednju stručnu spremu. 3,70% je imalo već prisutne promjene na rožnici, 50,37% pacijenata je imalo blagi oblik keratokonusa, najveći broj pacijenata (36,3%) imao je keratokonus oba oka, te keratokonus samo desnog oka (26,67%). Najbolja korigirana vidna oštrina s naočalama je bila  $0,37 \pm 0,27$ , a s kontaktnim lećama  $0,82 \pm 0,21$  prema Snellenu, postoji statistički značajna razlika u korist kontaktnih leća ( $p < 0,001$ ). Što se tiče tipova kontaktnih leća, u 51,85% pacijenata najbolja korigirana vidna oštrina potignuta je s RGP kontaktnim lećama, u 43,39% SGP lećama, u 4,23% PMMA, u samo 0,53% tvrdo-mekim GP lećama. Ovim istraživanjem pokazali smo da postoji statistički značajna razlika u najboljoj korigiranoj vidnoj oštrini s kontaktnim lećama u odnosu s naočalama. RGP kontaktne leće su najčešće korištene u konzervativnom liječenju keratokonusa, ali i SGP leće su se pokazale dobrim izborom u postizanju optimalne vidne oštrine u pacijenata s keratokonusom, uz subjektivno ugodniji osjećaj nošenja kontaktne leće.