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Utility of orthokeratology contact lenses; efficacy of myopia correction and level of patient satisfaction in Iranian myopic/myope-astigmatic patients

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Abstract

***Purpose*:** To investigate the medical profiles of patients referred to Iran Lens Clinic with myopic/myope-astigmatic refractive errors.
***Methods*:** Medical records of 182 patients (364 eyes) with myopic/myope-astigmatic refractive errors that underwent orthokeratology contact lens wear and fulfilled a 6-month period of follow-up were recruited. Efficacy and safety of these contact lenses in improving the visual acuity and correction of the refractive errors were investigated. Time needed to achieve final targeted visual acuity and association of various factors in this time course and level of acuity were investigated. Complications related to these lenses that were recorded in the medical profiles were studied.
***Results*:** In manifest refraction, the amount of spherical equivalent and myopia decreased significantly after orthokeratology contact lens wear ($P < 0.001$). A significant negative association was found between amount of mean baseline spherical equivalent and final achieved mean uncorrected visual acuity ($P < 0.001$). None of the parameters of age, gender, and keratometric findings influenced the outcomes significantly ($P > 0.1$).
***Conclusion*:** Patients with myopic refractive error lower than −5.0 Diopters achieved higher final visual acuities rather than patients with higher amounts of myopic refractive errors.
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Keywords: Orthokeratology; Myopia progression; Spherical equivalent

Introduction

As the most common human eye disorder, myopia has a various prevalence rate in different parts of the world. It is reported to affect 33% of adults in the US versus 85–90% in Asian countries.[1] Many modes of refractive correction have been investigated to hasten the progression of myopia. Orthokeratology (OK) is a developing field that has been established to slow down the progression of myopia.[1,2] Utility of contact lenses to alter the characteristics of the cornea to achieve stable improvement in visual acuity is in progress.[2] Uncorrected high myopia impairs functional capacity and is associated with concomitant retinal changes, cataract, and glaucoma, which might exclude the patients from being an eligible candidate for refractive surgery.[1–4] Meanwhile, not all patients have compliance for refractive surgery because of existing complications such as lower and higher order aberrations and decreased contrast sensitivity after correcting high

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amounts of myopia and astigmatism.[5] Modern orthokeratology introduces overnight use of reverse geometric designed rigid gas permeable contact lenses that are developed for reduction of myopia and astigmatism, by imposing some of the changes in corneal characteristics. These lenses can flatten the corneal apex and steepen the peripheral cornea, resulting in corneal sphericalization.[2] These alterations occur very rapidly and are shown to begin even in the first 10 min of lens wearing.[2] OK lenses also are supposed to slow down the progression of myopia.[3,4,6]

Besides growing techniques of modes of refractive correction, utility of OK lenses has its own certain field of indications, and due to the lack of information about clinical outcomes in Iranian patients, the current study was designed to investigate the efficacy of the orthokeratology contact lenses and to assess the satisfaction of the patients and rate of complications in the Iranian population.

Methods

The medical profiles of 182 myopic/myope-astigmatic patients (364 eyes) who had fulfilled a minimum of 6 months of follow-up in a contact lens clinic from June 2003 to January 2008 were evaluated. Only the medical profiles containing detailed results of auto kerato refractometry and manifest refraction, ocular slit-lamp examination, Goldmann tonometry, and funduscopic examination of the patients were included. Patients with any ocular abnormality other than refractive error, such as ocular hypertension, degrees of chorioretinal atrophy, and history of previous ocular surgery, were excluded. The modern overnight OK lenses (BOSTON XO) with 4 curves that were manufactured in Iran Lens Gostar Company were fitted for patients. The empirical lens fitting process had been performed by aid of a computer software program to obtain an ideal fit. First, back optic zone radius was chosen flatter than the flattest Kr. The initial base curve of the OK lens to initiate lens fitting is 0.3–1.4 mm flatter than the flattest Kr. By considering the amount of targeted refractive change, the mean of −0.75 was added to this figure. The sum of these two figures was subtracted from the dioptric power of back optic zone, and the radius was then calculated. The back vertex power is always +0.75 D because of the formation of the tear lens, no matter what the amount of myopia is. The reverse lens curve is chosen steeper than the steepest Kr of the cornea. The back optic zone diameter is commonly 6–6.5 mm. The fitting curve (the first back peripheral optic radius) is chosen 0.05 mm (0.25 D) flatter than flattest Kr. Lens fitting can be performed individually by manipulation various parameters to achieve the best outcomes. Fluorescein pattern of the eyes had been studied by slit lamp. Age, gender, baseline, final manifest refraction, spherical equivalent (SE), baseline corrected Snellen visual acuity (BCVA), final uncorrected Snellen visual acuity (UCVA), and baseline keratometry readings (Kr) were gathered for analysis. Recorded complications as found by the examiner or noted by the patients were extracted from the medical profiles. Eyes were divided into 4 age groups: 3 groups based on keratometric findings, and 4 groups upon their amount of spherical equivalent. Eyes also were divided into two groups based on recorded complications, and any significant difference between these groups were investigated. Complications had been listed in preformed papers that were included in each individual's medical profile in each follow-up session. Even the subtlest complications were recorded and were considered in the analysis. Statistical analysis was performed using SPSS for Windows software (Version 16, SPSS Inc.). A P less than 0.05 was considered statistically significant. Data are given as mean ± SD.

Results

In this study, there were 50 males and 132 females aged from seven to 58 years (21.91 ± 8.35); mean keratometry reading was (7.68 ± 0.26 mm); mean baseline BCVA was 0.003 ± 0.05 logMAR; mean final UCVA was 0.075 ± 0.2 logMAR. Mean spherical equivalent at baseline was −3.12 ± 0.63 D (ranged from −1.00 to −4.00 D) whereas mean final spherical equivalent was −1.36 ± 1.38 D ($P < 0.001$, paired T-test). Mean sphere at baseline was −2.87 ± 1.14 (ranged from −0.25 to −7.00 D) versus −0.98 ± 1.27 D finally. Mean astigmatism at baseline was −0.50 ± 0.52 D (ranged from −0.25 to −3.75 D), and final refraction revealed mean astigmatism of −0.75 ± 0.73 D.

As presented in Table 1, there was a significant association between baseline spherical equivalent and final UCVA ($P < 0.001$). A decreasing trend is detected in final UCVA as long as the increment of baseline spherical equivalent in the study population. There is no statistically significant association found between age and Kr, with final UCVA (Table 1).

The time to achieve the targeted visual acuity was compared between eyes with different spherical equivalents. As shown in Table 2, as the spherical equivalent of the study population increases, the time needed to achieve this parameter is more (Table 2). Also, analysis of our data considering mean amount of myopia revealed that patients with myopia lower than −5 D achieved better final permanent visual acuities and less time was needed for this achievement in comparison to patients with higher amounts of myopia ($P < 0.01$).

Table 1
Comparison of the final UCVA in different patient groups.

Final UCVA	Patient groups	Mean (logMAR)	SD	P
SE groups	SE ≤ −1.50	0.023	0.1	<0.001
	−1.50 < SE ≤ −3.50	0.077	0.2	
	−3.50 ≤ −5.50	0.101	0.2	
	SE > −5.50	0.192	0.2	
Kr groups	7 < Kr ≤ 7.5	0.085	0.2	0.70
	7.5 < Kr ≤ 8	0.079	0.2	
	Kr > 8	0.095	0.25	
Age groups	Age ≤ 15	0.085	0.2	0.26
	15 < age ≤ 25	0.078	0.2	
	25 < age ≤ 35	0.078	0.2	
	Age > 35	0.136	0.3	

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