

Introduction

Refractive changes ranging from -0.32 to -0.37 diopters (D) were observed in various studies 10 to 14 hours after contact lens removal [1-3]. In order to still provide good vision throughout the day, contact lens manufacturers incorporate an extra correction factor (compression factor) that accounts for diurnal regression [4]. European licensing authorities have instituted minimum vision requirements for obtaining driving privileges. For most European countries, the minimum monocular and binocular visual acuity (VA) requirements are +0.2 logMAR (decimal VA 0.6) and +0.3 logMAR (decimal VA 0.5) [5].

Purpose

The aim of this pilot study was to determine orthokeratology-related diurnal variations in visual acuity, contrast vision, twilight vision, and glare sensitivity and to verify compliance with requirements for driver licensing.

Methods

In this retrospective study 10 orthokeratology lens wearers (26.0±7.1 years) with average myopia of -2.43±0.97 D and astigmatism of -0.31±0.41 D were measured two times a day (08:30 am and 08:30 pm) using the Binoptometer 4P (Oculus, Wetzlar, Germany) (Figure 1). Monocular and binocular VA (Figure 2) were tested according to ISO 8596 and compared to European countries' VA requirements for car and motorcycle drivers. Furthermore, binocular contrast vision, twilight vision and glare sensitivity were tested at both visits (Figure 2). Differences between the morning and evening visit were tested with the paired-t-test or the Wilcoxon rank test (for non-normally distributed data).



Fig. 1: Binoptometer 4P (Oculus, Wetzlar, Germany).

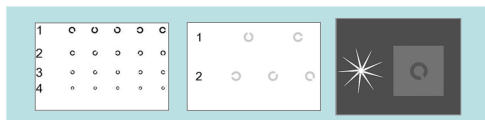


Fig. 2: Test sequence: Visual acuity (left image), contrast vision (middle image), twilight vision and glare sensitivity (right image).

	9 a.m.	9 p.m.	p-value
logMAR VA OD	-0.07 ± 0.16 (decimal 1.17)	-0.09 ± 0.14 (decimal 1.23)	p = 0.875
logMAR VA OS	-0.03 ± 0.15 (decimal 1.07)	-0.06 ± 0.17 (decimal 1.15)	p = 0.353
logMAR VA OU	-0.11 ± 0.15 (decimal 1.29)	-0.13 ± 0.13 (decimal 1.35)	p = 0.500

Fig. 3: Monocular and binocular visual acuity (LogMAR) achieved in the morning and evening.

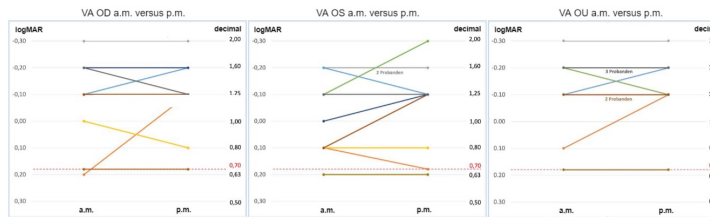


Fig. 4: Before-and-after plots comparing individual changes in visual acuity levels achieved in the morning and evening.

Results

There was no statistically significant difference between monocular VA (logMAR) in the morning (OD -0.07±0.16; OS -0.03±0.15) and evening (OD -0.09±0.14; OS -0.06±0.17) (p=0.875; p=0.353) or binocular VA in the morning (OU -0.11±0.15) and evening (OU -0.13±0.13) (p=0.500) (Figure 3). Decimal VA ranged from 0.63 to 2.00 monocularly and from 0.70 to 2.00 binocularly (Figure 4) which meets the required monocular VA limit of 0.60 and a binocular VA of at least 0.50 of most of the European countries. Furthermore, there was no statistically significant difference between contrast vision in the morning (11.5±3.4 %) and in the evening (15.5±9.3 %; p=0.07) (Figure 5), as well as twilight vision and glare sensitivity in the morning (both 0.27±0.09 logCS) and evening (both 0.27±0.09) (p=1.000) (Figure 6).

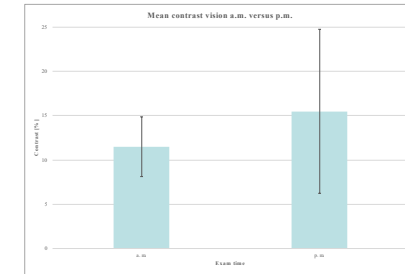


Fig. 5: Bar chart comparing the mean contrast values achieved in the morning and the evening.

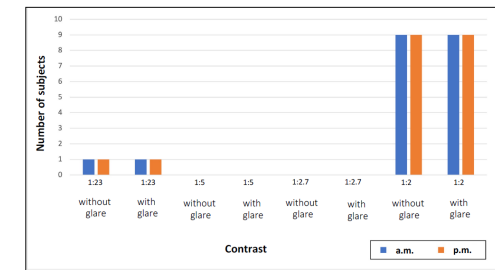


Fig. 6: Bar chart comparing the contrast ratios achieved with and without glare in the morning and evening.

Conclusion

Visual acuity of orthokeratology lens wearers seems to be stable throughout the day. Although the visual standards for driving are not uniform within the European countries, VA requirements of most countries are met. Contrast vision, twilight vision and glare sensitivity, which are suggested as other aspects of driving performance also appear to be constant over the course of the day.

References

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Author contact: jessica.gruhl@avermann-contactlinsen.de