RESEARCH ARTICLE

The impact of wearing single vision soft contact lenses on the peripheral refractive error [version 1; peer review: 2 approved with reservations]

Kareem Allinjawi, Sharanjeet-Kaur Sharanjeet-Kaur, Saadah Mohamed Akhir, Haliza Abdul Mutalib

Faculty of Health Science, University Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, Kuala Lumpur, 50300, Malaysia

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Abstract

Aim: The purpose of this study was to determine the changes in the relative peripheral refractive error produced by soft single vision contact lenses in myopic schoolchildren.

Methods: 27 myopic schoolchildren aged between 13 to 15 years were included in this study. The measurements of central and peripheral refraction were made only on the right eye using a Grand-Seiko WR-5100K open-field autorefractometer without contact lens (WL), and with wearing single vision contact lens (SVCL). Refractive power was measured at center and horizontal eccentricity between 35° temporal to 35° nasal visual field (in 5° steps).

Results: SVCL showed an increase in peripheral hyperopic defocus at the nasal and temporal visual field compare with baseline, but this change was not statistically significant ($p=0.129$).

Conclusion: Wearing single vision soft contact lenses increases the relative peripheral hyperopic defocus in myopic schoolchildren.

Keywords

Myopia , hyperopic defocus , peripheral retina , soft contact lenses

This article is included in the Eye Health gateway.

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1. **Li-Fang Hung**, University of Houston, Houston, USA

2. **Pauline Kang**, University of New South Wales, Sydney, Australia

Any reports and responses or comments on the article can be found at the end of the article.

Corresponding author: Sharanjeet-Kaur Sharanjeet-Kaur (Sharanjeet@ukm.edu.my)

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Introduction

Myopia is the most common type of refractive errors¹. It is considered a global health problem. Studies have shown that the myopic eye has a more prolated retinal shape compared to emmetropes²⁻⁴. Soft contact lenses are commonly used to correct refractive errors especially in young adults. Using these lenses has become the most widely affordable correction of myopia with an extensive range of power and designs available, and such lenses are frequently worn by myopic children and adults. The contact lens usually affords a wider visual field, better life-style, and better appearance compare with spectacles. However, the incidence rate of microbial keratitis infection ranges from 2.2 to 4.1/10,000 per year for users of 'daily-wear soft contact lenses, and this rate increases for users of extended-wear soft contact lenses from 13.3 to 20.9/10,000 per year⁵.

Although contact lenses are prescribed to correct the central vision, using them has no effects on the blurred image at the peripheral visual field, which eventually could influence the axial growth of the eyeball. The myopic eye typically demonstrates peripheral retinal hyperopic defocus which results in the eye growing axially backward in order to overcome the blur at the periphery. Studies conducted by Smith and colleagues in monkeys have shown that not only the fovea, but also the peripheral retina, is capable of regulating the emmetropization process⁶⁻⁸. This shows that the peripheral retina is important in determining the ocular development and refractive error. Evidence suggests that hyperopic defocus is associated with progression of myopia in humans^{9,10}. Lin *et al.* (2010) reported that hyperopic defocus worsens with higher degree of myopia and eccentricity¹¹.

The impacts of single vision soft contact lenses (SVCL) on the peripheral refraction profile is still in debate. A recent study reported a reduction of relative peripheral hyperopic defocus with using Acuvue 2 SVCL by Johnson & Johnson¹². However, another study by Kang *et al.* (2012)¹³ recruited 34 young adults aged between 18 and 29 years found an increase in relative peripheral hyperopic defocus when full-correction Proclear SVCL by CooperVision were compared with the naked eye. Since there is evidence of the potential impact of peripheral refraction defocus on the progression of myopia, this study set out to determine the changes in relative peripheral refractive error (RPRE) produced by soft single vision contact lenses in myopic schoolchildren. To date, no study has evaluated the impact of SVCL wearing on the retinal profile in myopic children.

Methods

A total of 27 myopic Malaysian schoolchildren (24 females, 3 males) aged between 13 and 15 years were recruited for this cross-sectional study. The study was conducted at the Universiti Kebangsaan Malaysia (UKM) Optometry Clinic and Vision Science Lab. Written informed consent was obtained before enrolment into the study. This research was approved by the Ethics Committee of Universiti Kebangsaan Malaysia (UKM 1.5.3.5/244/NN-144-2013) and followed the tenets of the Declaration of Helsinki for using human subjects. The purpose and procedure of the study were explained to all participants and their parents.

Children eligible for this study were required to have 6/9 visual acuity or better with best correction, been myopic for more than 6 months, with a spherical component refractive error range between -3.00 to -6.00 D under non-cycloplegic refraction, astigmatism not more than -1.00 D, and having normal ocular and systemic health conditions. Children with manifested strabismus, amblyopia, any ocular conditions associated with myopia, a history of bifocal or progressive spectacles wear, orthokeratology contact lens wear, or currently wearing soft contact lens, were excluded from participation in this study.

A comprehensive ocular examination, which included fundus evaluation, anterior segment assessment, and A-scan ultrasound, was conducted by an experienced optometrist to select the candidates. An ultrasound A-scan (Tomey AL-2000) was used to measure axial length using a handheld probe. The final outcome was calculated as the mean of five measurements.

The spherical equivalent refractive error (M) for each subject was determined using non-cycloplegic objective and subjective refraction. Central and peripheral refraction were measured using an open-view autorefractometer Grand-Seiko WR-5100K (Grand Seiko Co., Ltd., Hiroshima, Japan). The examination room illumination was dimmed (mean of three measurements: 9.91 ± 1.73 lux, measured using Topcon Luxmeter) to obtain a sufficiently large pupil size enough to measure peripheral retina without using dilatation drops. The measurement was obtained initially without correction lenses (WL), then re-measured again using single vision soft contact lens (SVCL). The subjects were instructed to view fixation targets (green light laser) located at 4 meters arranged horizontally in the positions corresponding to eccentricities from 35° temporal to 35° nasal, in 5° steps. The straight ahead viewing technique was used in this study where the subjects rotated their eyes to view a series of fixation targets. Five refraction measurements were taken at each target fixation for the right eye only, while the left eye was occluded. For statistical analysis, the spherocylindrical refractive error measurements were converted into vector components of refraction M , J_0 , J_{45} using the equations recommended by Thibos *et al.* (1997)¹⁴ M , J_0 and J_{45} according to Fourier analysis,

$$M = \text{sph} + (\text{cyl}/2),$$

$$J_0 = (-\text{cyl}/2) \cos(2\alpha),$$

$$J_{45} = (-\text{cyl}/2) \sin(2\alpha),$$

where sph, cyl, and (α) represent sphere, cylinder, and axis, respectively. The relative peripheral refractive error (RPRE) was calculated as the difference between eccentric peripheral refraction and central refraction (the eccentricity point minus the centre value).

Contact lens design and materials

All subjects were fitted with single vision contact lenses to their right eyes. Lens powers fully corrected the central refractive error. The lens used in this study was '2 week Pure' by SEED Co. Ltd, Japan. It is a spherical biweekly disposable soft contact lens made

of Zwitterionic material SIB (FDA Group IV), 58% water content, with a diameter of 14.2 mm and a base curve of 8.6 mm. The SIB is SEED's original material with superior biocompatibility, similar in structure to protein which is a basic constituent of a human body by containing both positive and negative ions.

Statistical analysis

The statistical analysis software (IMB SPSS version 20, SPSS Inc, IL, USA) for Windows was used to evaluate the data. Only data from the right eye were analysed. Normality of data distribution was tested used Shapiro- Wilk test. A Paired t-test was used to compare the baseline (without correction) and single vision contact lens at the different eccentricities. The differences were considered statistically significant when the p value was lower than 0.05.

Results

A total of 27 myopic schoolchildren with a mean age of 14.18 ± 0.88 years (range: 13 years to 15 years) participated in this study with mean axial length of the eye was 24.72 ± 0.92 mm (range: 23.5 mm to 26.39 mm). Table 1 illustrates the mean spherical equivalent value and the peripheral refraction along the horizontal visual field. The mean central refractive error for the baseline and single vision contact lens was -4.39 ± 0.95 D and -0.22 ± 0.22 D, respectively. The minus value

decreased with the farther off-axis which indicated hyperopic shift at the peripheral retina.

Compared with the baseline (without contact lens), the '2 week Pure' single vision contact lens from SEED® caused an increase in relative peripheral hyperopia from 10° and beyond in the nasal visual field (VF), and from 20° and beyond in the temporal VF. Table 2 illustrates the mean and standard deviation for the relative peripheral refractive error (RPRE) for the baseline and when using SVCL, as well as the significant P value using paired t-test for the centre refraction and off-axis measured. The baseline showed a statistically significant difference between centre refractive error and 30° and 35° in nasal VF ($p=0.001$), and from 25° and beyond in temporal VF ($p<0.05$). However, the statistical significant difference started from 20° and beyond in nasal and temporal VF when using the single vision contact lens ($p<0.05$). Moreover, J_0 and J_{45} showed no statistically significant difference between the centre refraction and all eccentricity points for baseline and with using SVCL, except J_{45} at 5° nasal VF with using SVCL ($p=0.026$).

Figure 1 illustrates the RPRE without contact lenses and with SVCL for the spherical equivalent value M , horizontal astigmatism component J_0 , and oblique astigmatism component J_{45} . The hyperopic defocus is greater at the nasal and temporal visual field in

Table 1. Mean spherical equivalent ($M \pm SD$), horizontal astigmatism component ($J_0 \pm SD$) and oblique astigmatism component ($J_{45} \pm SD$) for 27 eyes at different eccentricities without lens, and with using SVCL. Values are expressed in dioptres (D). N is nasal visual field; T is temporal visual field; C is centre.

	M		J_0		J_{45}	
	WL	SVCL	WL	SVCL	WL	SVCL
N35	-3.32 ± 1.59	1.14 ± 1.15	0.11 ± 0.84	0.2 ± 0.79	0.18 ± 0.91	-0.07 ± 0.81
N30	-3.6 ± 1.49	0.75 ± 0.91	0.02 ± 0.93	-0.06 ± 0.63	-0.15 ± 0.58	0.09 ± 0.6
N25	-4.09 ± 1.36	0.36 ± 0.78	0.06 ± 0.7	-0.03 ± 0.55	-0.18 ± 0.58	-0.11 ± 0.5
N20	-4.31 ± 1.09	0.01 ± 0.62	0 ± 0.36	-0.03 ± 0.33	0.07 ± 0.51	-0.04 ± 0.32
N15	-4.41 ± 1.11	-0.18 ± 0.43	0.01 ± 0.28	-0.05 ± 0.25	0.05 ± 0.37	-0.04 ± 0.28
N10	-4.43 ± 0.93	-0.13 ± 0.35	-0.03 ± 0.23	-0.05 ± 0.22	-0.04 ± 0.25	-0.04 ± 0.24
N5	-4.37 ± 0.89	-0.27 ± 0.34	0 ± 0.27	0.11 ± 0.26	-0.01 ± 0.23	0.02 ± 0.24
C	-4.39 ± 0.95	-0.22 ± 0.22	-0.04 ± 0.25	0.02 ± 0.22	-0.03 ± 0.23	-0.02 ± 0.29
T5	-4.2 ± 0.98	-0.34 ± 0.47	0.02 ± 0.26	-0.04 ± 0.22	-0.06 ± 0.28	-0.01 ± 0.23
T10	-4.52 ± 1.04	-0.33 ± 0.49	0.07 ± 0.31	-0.09 ± 0.23	0.02 ± 0.32	-0.03 ± 0.21
T15	-4.33 ± 1.34	-0.25 ± 0.63	0.03 ± 0.34	-0.02 ± 0.27	-0.07 ± 0.27	-0.06 ± 0.34
T20	-4.19 ± 1.2	0.2 ± 0.91	-0.07 ± 0.38	0 ± 0.34	-0.04 ± 0.36	-0.07 ± 0.38
T25	-3.86 ± 1.31	0.46 ± 0.88	-0.05 ± 0.34	-0.02 ± 0.27	-0.01 ± 0.36	-0.01 ± 0.31
T30	-3.63 ± 1.35	0.68 ± 1.03	-0.07 ± 0.54	0.05 ± 0.33	0.11 ± 0.41	0.04 ± 0.46
T35	-3.34 ± 1.32	0.97 ± 1.01	0.13 ± 0.5	-0.05 ± 0.4	-0.01 ± 0.59	-0.09 ± 0.37

Table 2. Relative peripheral refractive error as mean spherical equivalent values ($M \pm SD$), horizontal astigmatism component ($J_0 \pm SD$) and oblique astigmatism component ($J_{45} \pm SD$) for 27 eyes at baseline and with using SVCL. Legend: Values are expressed in diopters (D). N is nasal visual field; T is temporal visual field; C is center. Bold indicates statistically significant power difference from central point (95% confidence).

	M		J_0		J_{45}	
	WL $\pm$ SD Sig. (p)	SVCL $\pm$ SD Sig. (p)	WL $\pm$ SD Sig. (p)	SVCL $\pm$ SD Sig. (p)	WL $\pm$ SD Sig. (p)	SVCL $\pm$ SD Sig. (p)
N35	1.08 $\pm$ 1.24 < 0.001	1.36 $\pm$ 1.12 < 0.001	-0.33 $\pm$ 0.84 0.090	0.02 $\pm$ 0.56 0.985	0.17 $\pm$ 1.02 0.440	-0.03 $\pm$ 0.87 0.884
N30	0.8 $\pm$ 1.1 0.001	0.97 $\pm$ 0.88 < 0.001	0.4 $\pm$ 1.03 0.855	-0.07 $\pm$ 0.72 0.641	-0.19 $\pm$ 0.61 0.139	0.21 $\pm$ 0.74 0.194
N25	0.31 $\pm$ 0.86 0.074	0.59 $\pm$ 0.71 < 0.001	0.1 $\pm$ 0.7 0.495	-0.01 $\pm$ 0.58 0.908	-0.19 $\pm$ 0.7 0.190	-0.04 $\pm$ 0.56 0.729
N20	0.09 $\pm$ 0.57 0.429	0.24 $\pm$ 0.56 0.035	0.05 $\pm$ 0.51 0.629	-0.11 $\pm$ 0.45 0.277	0.01 $\pm$ 0.42 0.953	0.02 $\pm$ 0.39 0.837
N15	0.03 $\pm$ 0.43 0.717	0.04 $\pm$ 0.34 0.529	0.02 $\pm$ 0.29 0.683	-0.03 $\pm$ 0.33 0.635	-0.03 $\pm$ 0.3 0.674	0.04 $\pm$ 0.38 0.635
N10	0.02 $\pm$ 0.35 0.716	0.06 $\pm$ 0.25 0.206	0.03 $\pm$ 0.32 0.630	-0.06 $\pm$ 0.32 0.366	-0.04 $\pm$ 0.23 0.386	0 $\pm$ 0.29 0.956
N5	0.02 $\pm$ 0.19 0.578	-0.04 $\pm$ 0.25 0.351	-0.01 $\pm$ 0.37 0.865	0.04 $\pm$ 0.36 0.612	-0.01 $\pm$ 0.26 0.911	0.13 $\pm$ 0.26 0.026
T5	-0.02 $\pm$ 0.31 0.708	-0.12 $\pm$ 0.43 0.171	0.09 $\pm$ 0.28 0.125	0.01 $\pm$ 0.26 0.961	-0.06 $\pm$ 0.37 0.428	0.03 $\pm$ 0.26 0.597
T10	-0.13 $\pm$ 0.50 0.196	-0.1 $\pm$ 0.46 0.244	0.05 $\pm$ 0.32 0.421	-0.09 $\pm$ 0.38 0.274	0 $\pm$ 0.35 0.972	0.03 $\pm$ 0.31 0.653
T15	0.06 $\pm$ 0.92 0.733	-0.02 $\pm$ 0.57 0.847	0.06 $\pm$ 0.33 0.398	-0.01 $\pm$ 0.29 0.914	-0.08 $\pm$ 0.28 0.144	-0.03 $\pm$ 0.39 0.705
T20	0.2 $\pm$ 0.77 0.178	0.42 $\pm$ 0.85 0.018	-0.02 $\pm$ 0.48 0.852	0.01 $\pm$ 0.37 0.903	-0.07 $\pm$ 0.44 0.408	-0.02 $\pm$ 0.38 0.786
T25	0.54 $\pm$ 0.90 0.018	0.66 $\pm$ 0.86 < 0.001	-0.01 $\pm$ 0.37 0.894	0.04 $\pm$ 0.36 0.577	-0.02 $\pm$ 0.45 0.805	0.04 $\pm$ 0.39 0.645
T30	0.76 $\pm$ 1.09 0.001	0.9 $\pm$ 0.97 < 0.001	0.09 $\pm$ 0.42 0.310	0.03 $\pm$ 0.41 0.668	0.1 $\pm$ 0.42 0.250	0.04 $\pm$ 0.44 0.662
T35	1.06 $\pm$ 1.06 < 0.001	1.23 $\pm$ 0.96 < 0.001	-0.01 $\pm$ 0.46 0.967	-0.08 $\pm$ 0.43 0.389	-0.03 $\pm$ 0.61 0.793	-0.01 $\pm$ 0.42 0.922

the spherical equivalent values M graph. However, J_0 and J_{45} graphs show flat curves from central toward both peripheral sides which indicates no changes at the relative peripheral refraction in baseline as well as in SVCL.

Although the mean spherical equivalent value M was greater when using single vision soft contact lens SVCL compared with no correction (WL) at all eccentricities, the paired sample t-test used to compare the mean spherical equivalent M between baseline and SVCL showed no statistical significant difference among all eccentricity points ($p > 0.05$) except at 25° temporal VF ($p=0.013$) and 20° nasal VF ($p=0.004$). The horizontal astigmatism component J_0 , and oblique astigmatism component J_{45} showed no

Dataset 1. Spherical equivalent refractive error M

<http://dx.doi.org/10.5256/f1000research.10080.d143978>

The spherical equivalent refractive error M was measured for each participant with and without contact lenses.

Dataset 2. Horizontal astigmatism components J_0

<http://dx.doi.org/10.5256/f1000research.10080.d143979>

The horizontal astigmatism components J_0 were measured for each participant with and without contact lenses.

Figure 1. The relative peripheral refractive error for baseline (without contact lens) and with using single vision contact lens. The spherical equivalent value M , horizontal astigmatism component J_0 , and oblique astigmatism component J_{45} in condition of baseline and with using single vision contact lens (SVCL).

Dataset 3. Oblique astigmatism components J_{45}

<http://dx.doi.org/10.5256/f1000research.10080.d143980>

The oblique astigmatism components J_{45} was measured for each participant with and without contact lenses.

Dataset 4. Relative peripheral refractive error M

<http://dx.doi.org/10.5256/f1000research.10080.d143981>

The relative peripheral refractive error M was calculated for each participant with and without contact lenses.

Dataset 5. Relative peripheral horizontal astigmatism J_0

<http://dx.doi.org/10.5256/f1000research.10080.d143982>

The relative peripheral horizontal astigmatism J_0 was calculated for each participant with and without contact lenses.

Dataset 6. Relative peripheral oblique astigmatism J_{45} w

<http://dx.doi.org/10.5256/f1000research.10080.d143983>

The relative peripheral oblique astigmatism J_{45} was calculated for each participant with and without contact lenses.

statistically significant difference at all eccentricity points between baseline and when using SVCL.

Discussion

With the extensive range of powers and materials of single vision soft contact lenses available, these lenses have become one of the most popular myopia correction modes widely used by young adults. In this study, we evaluated the relative peripheral refractive error along the horizontal meridian. The myopic children who participated in this research were found to have relative hyperopic defocus in the peripheral retina. However, full central myopia correction with using SVCL was found to cause a greater relative hyperopic shift at all eccentricity along the horizontal meridian compared with baseline (WL). The results are in agreement with a study by Kang *et al.* (2012)¹³ who found an increase of relative hyperopic defocus for young adult wearing Proclear soft contact lenses when compared with the peripheral refraction measurement of the eye without correction.

Few studies have attempted to observe myopia progression when SVCL are used for full correction. In the early 1970s, several studies reported an increase of myopia progression rate with soft contact lens wearers^{15,16}. However, a recent study found a decrease of progression rate¹⁷, while Andreo (1990)¹⁸ reported no difference between daily soft contact lens wearers and spectacles wearers in myopia progression after one year of study. A three year randomized clinical study reported no difference in myopia progression between SVCL and spectacle lens wearers among

children aged between 11 and 14 years old¹⁹. Moreover, Walline *et al.* (2008)²⁰ conducted a study of 247 soft contact lens and 237 spectacles wearers aged between 8 and 11 years. The study confirmed that SVCL has no significant effect on axial length or corneal curvature progress compared with spectacles group.

Fulk *et al.* (2003)²¹ found in a 1-year study a three times higher rate of myopia progression (-0.75D/year) in children who chose to switch from spectacle lens to SVCL compared with children who continued to wear spectacles who had average myopia progression (-0.23D/year). Moreover, a recent non randomized longitudinal study over 2 years reported a statistically significant but clinically not significant increase in myopia progression for children who chose to switch from spectacles to soft contact lenses -0.52 ± 0.46 D compared with children remained on wearing spectacle lens -0.25 ± 0.39 D²². This higher rate of progression found with SVCL wearers is in agreement with our findings of an increased relative peripheral retinal hyperopic defocus when using SVCL compare with baseline (without contact lens). Taking results of these studies together, we expect that when children wear the SVCL for prolonged periods of time the induced higher relative hyperopic defocus will speed up the progression of myopia.

It is believed that hyperopic defocus in the peripheral retina stimulates myopia progression and axial elongation²³. Wagner *et al.* (2013)²⁴ demonstrated the optical profile power measurement from central to peripheral retina for six popular single vision commercial soft contact lenses. They found that most of the standard single vision soft contact lenses for myopes have more minus power toward the periphery zone. Therefore, prescribing contact lenses which increase the minus power at the periphery would explain the results of previous studies which showed an increase of myopia progression in SVCL wearers compared with spectacle lens wearers. This might also explain the increase of relative peripheral hyperopic refraction in myopic children we observed in this study compared with the baseline (without correction), which could be due to the increase of minus power at the periphery of the '2 week pure' single vision soft contact lens.

A recent study by Blacker *et al.* (2009)²⁵ in the United States compared the progression of myopia in children wearing single vision soft contact lenses of two different material groups. The study reported progression of myopia +0.02 D for those who used silicon hydrogel lenses compared with -0.41 D for low Dk/t for those wearing hydrogel contact lenses over 3 years. However, the study was non-randomized and the sample size was not matched between the groups where there were 54 patients wearing hydrogel and 230 patients wearing silicon hydrogel contact lenses, and the aged group was 38 ± 11 years for silicone hydrogel contact lens wearers compared with 23 ± 12 years for Low Dk/t contact lens wearers. A previous randomized study on 92 adult subjects reported myopia progression by $+0.18 \pm 0.33$ D in silicone hydrogel group compared with a -0.23 ± 0.36 D low Dk/t hydrogel group after 6 months extended wear²⁶. The authors hypothesized that pressure related to contact lens wearing has a direct impact on the redistribution of corneal tissue when using high Dk/t silicone hydrogel soft contact lenses. Moreover, low Dk/t hydrogel

material could lead to hypoxia-associated corneal thinning which could temporarily influence the results. In this research we used hydrogel single vision contact lens made of zwitterionic material SIB and high water content.

Conclusions

This study demonstrates that wearing single vision soft contact lenses increases the relative peripheral hyperopic defocus in myopic schoolchildren. Although the higher values found in SVCL compared with naked eye were statistically and clinically not significant, it is possible that wearing soft contact lenses at childhood age for a prolonged period might speed up the progression rate of myopia. However, a longitudinal study using '2 week Pure' single vision contact lens from SEED® is needed to evaluate the impact of wearing this contact lens on myopia progression in children.

Data availability

F1000Research: Dataset 1. Spherical equivalent refractive error M , [10.5256/f1000research.10080.d143978](https://doi.org/10.5256/f1000research.10080.d143978)²⁷

F1000Research: Dataset 2. Horizontal astigmatism components J_0 , [10.5256/f1000research.10080.d143979](https://doi.org/10.5256/f1000research.10080.d143979)²⁸

F1000Research: Dataset 3. Oblique astigmatism components J_{45} , [10.5256/f1000research.10080.d143980](https://doi.org/10.5256/f1000research.10080.d143980)²⁹

F1000Research: Dataset 4. Relative peripheral refractive error M , [10.5256/f1000research.10080.d143981](https://doi.org/10.5256/f1000research.10080.d143981)³⁰

F1000Research: Dataset 5. Relative peripheral horizontal astigmatism J_0 , [10.5256/f1000research.10080.d143982](https://doi.org/10.5256/f1000research.10080.d143982)³¹

F1000Research: Dataset 6. Relative peripheral oblique astigmatism J_{45} w, [10.5256/f1000research.10080.d143983](https://doi.org/10.5256/f1000research.10080.d143983)³²

Author contributions

SK = designed the experiment & conceived the study. HAM: Data analysis.

Competing interests

No competing interests were disclosed.

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The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Pauline Kang

School of Optometry and Vision Science, University of New South Wales, Sydney, NSW, Australia

This study evaluated changes in peripheral refraction induced by '2 week pure' soft contact lenses in a group of children. There are issues which need to be addressed as described below:

General comments:

Why do authors expect there to be a difference in peripheral refraction changes to published reports on adults, if peripheral refraction has been shown to be relatively similar between myopic children and adults?

Furthermore, these results cannot be generalised to all contact lenses and is specific for the included lens design.

If results are not statistically significant, authors should not state that SVCLs increased relative hyperopic defocus.

The discussion details many studies exploring differences in myopia progression between SVCLs, spectacles, and between different materials of SVCLs. Instead, authors should compare peripheral refraction profiles to previous publications in children.

Limitations of instrumentation has not been discussed – authors only measured peripheral refraction along the horizontal meridian and it has been shown that the vertical meridian tends to demonstrate myopic defocus in myopic individuals. Furthermore, the autorefractor samples within a small arc which may mask subtle changes, which may be a possible reason for non-significant changes reported in this study.

Authors need to be careful in statements regarding peripheral vision/refraction and myopia/emmetropization as these are hypotheses or proposals that have not been fully validated.

Minor comments:

Abstract:

- Conclusion: Results are not statistically significant therefore authors should not state that SVCLs increased relative hyperopic defocus.

Introduction - first paragraph:

- Why is myopia considered a global health problem?
- Prolate, not prolated
- Replace affordable with a more appropriate word

Introduction – second paragraph:

- There have been numerous studies have characterised changes in peripheral vision or defocus with various single vision and multifocal soft contact lenses.
- Peripheral hyperopic defocus is believed to cause axial length elongation
- More recent evidence has suggested that peripheral hyperopic defocus may be a consequence rather than cause of myopia development.

Methods:

- Were p values adjusted to take into account multiple comparisons?
- How long were contact lenses worn before measurements were taken?
- Did authors note any decentration in their subjects, as this may influence results

Results – first paragraph:

- Remove the last sentence

Figure keys:

- baseline, not base

Table 1, 2 and Figure 1:

- I am surprised with such low J_0 values in the periphery?

Discussion – first paragraph :

- the results were not statistically significant, therefore authors should not state that the contact lenses induced any changes in relative peripheral refraction.

Fourth paragraph:

- this is true if peripheral defocus is to some extent responsible or involved in myopia development. This is currently still under debate.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 08 February 2017

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Li-Fang Hung

College of Optometry, University of Houston, Houston, TX, USA

1. I would suggest the authors change the topic and revise the conclusion (in text and abstract) of the manuscript. Due to the differences of contact lens power profiles made by different contact lenses manufacturers, the peripheral refractions would be influenced when the subjects wear SVCLs made by different manufacturers. This study only use one particular brand of contact lenses, hence, cannot conclude that all the SVCLs would have the same impact on the peripheral refraction.
2. First line of the second paragraph in the introduction: Although contact lens focus on correcting the central vision, the peripheral image, in most of the conditions, will still be improved, just not so accurate (or adequate) as that of central vision. Please revise the sentence.
3. Last sentence in the introduction: Currently, there are more published studies that evaluate the SVCL wearing on the retinal profile in myopic children now. Please revise the last sentence and add references.
4. For the statistical analysis: When comparing different eccentricities, it involved multiple comparison problem. It is prefer to use multiple comparison corrections.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

No

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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