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A comparison of vision-related quality of life between Defocus Incorporated Soft Contact (DISC) lenses and single-vision spectacles in Chinese children

Ding Han, Ziyu Zhang, Bei Du, Lin Liu, Meinan He, Zhuzhu Liu, Ruihua Wei*

Tianjin Key Laboratory of Retinal Functions and Diseases, Tianjin Branch of National Clinical Research Center for Ocular Disease, Eye Institute and School of Optometry, Tianjin Medical University Eye Hospital, Tianjin 300384, China

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ABSTRACT

Objective: This study aimed to compare the vision-related quality of life (VRQoL) between Defocus Incorporated Soft Contact (DISC) lenses and single-vision spectacles in Chinese children, in order to evaluate their visual performance and subjective acceptance of this bifocal designed contact lenses treatment.

Methods: Chinese participants aged 7 to 12 years, with myopia of -4.00 to -0.75 D, astigmatism < 1.50 D, and monocular best-corrected visual acuity 0.0 or better, were recruited in the study. All participants had been wearing DISC lenses, or single-vision spectacles, for the last 6 to 18 months and were requested to complete the routine ocular examination and Chinese version of the Pediatric Refractive Error Profile (PREP 2) questionnaire. The questionnaire consisted of 7 scales: vision, symptoms, appearance, activities, handling, peer perception, and overall score. According to their habitual correction modalities, fifty-four children were allocated to the DISC group and 56 to the single-vision spectacles group. A generalized linear model was fitted to assess variables associated with the PREP 2 score.

Results: Participants wearing DISC lenses scored significantly higher than those wearing single-vision spectacles for vision, appearance, activities, peer perception, and overall (all $P < 0.05$). The improvement of VRQoL in the DISC group was mainly represented in appearance, peer perception, and activities. The quality of life improved more for older participants on scales of vision, symptoms, handling, appearance, and overall score (all $P < 0.05$). The interaction between treatment and age was statistically significant for the activities scale ($P < 0.05$).

Conclusion: DISC lens wear significantly improves VRQoL in Chinese children compared with single-vision spectacles for most of the survey scales, especially in the areas of appearance, peer perception, and activities. The benefits provided by DISC lenses contribute to greater satisfaction than single-vision spectacles for myopic children.

1. Introduction

There is an epidemic of myopia in children worldwide in recent years, particularly in some developed countries of east and southeast Asia [1–4]. Because high myopia may result in severe pathological changes and consequent visual impairment, it is urgent and necessary to take measures to prevent the progression of myopia in this susceptible population. Various interventions have proved to be effective in myopic control for children [5–7]. However, improper corrections could lead to poor vision-related quality of life (VRQoL), manifested as reduced visual performance, limitations in daily life activities, and decreased life satisfaction. Therefore, the VRQoL should also be focused upon to comprehensively evaluate the visual performance and subjective

acceptance of these approaches.

Some standardized questionnaires have been widely used to evaluate the VRQoL in clinical research. The Pediatric Refractive Error Profile (PREP) questionnaire has been specifically designed to evaluate VRQoL in children with refractive error [8,9]. The PREP 2, an updated version of PREP, exhibits good reliability and validity, and could be used as a significant means of quantifying the visual performance and satisfaction levels between various refractive corrections [10–12]. Some studies compare the VRQoL scores in children wearing soft contact lenses (CLs) and single-vision spectacles, and the results reveal that participants with soft CLs report a better VRQoL, especially in the scales of appearance, activities and satisfaction with correction [13–15]. Myopic children wearing orthokeratology (OK) contact lenses also

* Corresponding author.

E-mail address: rwei@tmu.edu.cn (R. Wei).

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report significant improvement in the VRQoL when compared to those wearing single-vision spectacles for all survey scales, except for handling and near vision [16].

Recent studies have indicated that the bifocal CLs could effectively retard myopia progression in children compared with single-vision spectacles [3,17–20]. However, few studies have focused on the visual performance and VRQoL in children wearing these lenses. One previous study indicated that Spanish children wearing MiSight CLs, a bifocal designed soft CLs, significantly improve VRQoL scores at 12- and 24-month follow-up visits, as regard appearance, satisfaction, activities, handling, peer perceptions, and the overall score in comparison with single-vision spectacles wear [21].

With the dramatically growing incidence of myopia in at-risk child populations in China, parents are apparently worried and tend to use various approaches to control myopia progression. Low-concentration atropine eye drops have not been officially approved for myopia control by the Chinese Food and Drug Administration [22]. Some specially designed lenses are popular among children in China, for example, bifocal soft CLs, OK contact lenses and bifocal spectacles. However, OK contact lenses are only officially approved for those no younger than eight years old in China, and are often provided to mild to moderate myopic children [23]. Meanwhile, many children or their parents tend to choose contact lenses because of their advantages for activities such as sports or dancing and prefer their appearance compared to spectacles [14,15]. Therefore, bifocal soft CLs are an effective and distinctive choice for myopia control in China. The Defocus Incorporated Soft Contact (DISC) lens is a bifocal soft CL with a concentric ring design, comprised of a correction zone in the center and alternating treatment and correction zones extending towards the periphery. It is intended to simultaneously generate myopic retinal defocus and maintain clear vision [19]. DISC lenses have become increasingly popular for myopia control in China in recent years. However, previous studies have not investigated the vision-related quality of life among Chinese children wearing this bifocal CL.

Therefore, the aim of this study was to compare the VRQoL between children wearing DISC lenses and single-vision spectacles in a sample of Chinese children using the Chinese version of the PREP 2 questionnaire, in order to evaluate the visual performance and subjective acceptance of this bifocal designed CL treatment.

2. Materials and methods

2.1. Participants

This was a retrospective cross-sectional study. Chinese participants aged 7 to 12 years, with myopia from -4.00 to -0.75 D, astigmatism < 1.50 D, and monocular best-corrected visual acuity (BCVA) of 0.0 or better, participated in the study. All participants had already been wearing DISC lenses or single-vision spectacles for the last 6 to 18 months and had no systemic or ocular disease. Participants were recruited when they came back for the follow-up visit in the out-patient clinic of the Tianjin Medical University Eye Hospital, China.

In the current study, the DISC lenses were bifocal and concentric designed soft CLs, consisting of a central correction zone to correct the refractive error, and a series of surrounding treatment and correction zones extending to the periphery, which could result in 3.00 diopters of myopic retinal defocus. The contact lenses were made from hydroxyethyl methacrylate, with 55 % water content, diameter of 14.2 mm, and base curve of 8.6 mm.

The protocol of the study was reviewed and approved by the ethics committee of the Tianjin Medical University Eye Hospital, China, following the tenets of the Declaration of Helsinki. After a verbal explanation of the purpose and possible risks of the study, both the children and their parents provided informed consent to take part in the study.

2.2. Measurements

All participants were required to complete the Chinese version of the PREP 2 questionnaire before ocular examination. BCVA were obtained with the trial frame and recorded as the logarithm of the minimal angle of resolution (LogMAR). Refractive error was measured by cycloplegic subjective refraction using 1.0 % tropicamide drops. The demographic characteristics and duration of lens wearing was also recorded.

The Chinese version of the PREP 2 questionnaire was translated according to standardized procedure and showed good acceptability, reliability, and validity [12]. It consisted of 7 scales: vision, symptoms, appearance, activities, handling, peer perception, and the overall score, and each scale contains 8 statements [12]. The answers of each statement consist of “strongly disagree,” “disagree,” “neutral,” “agree,” or “strongly agree,” with raw scores from 1 (negative) to 5 (positive) accordingly. The final scores were recorded by subtracting one from the raw score and multiplying by 25, and scaled from 0 (poor visual quality of life) to 100 (good visual quality of life). All participants were requested to read and complete all the 56 questions carefully, and choose only one answer for each question.

The PREP 2 questionnaire was administered by a researcher who did not participate in the data processing. The children were asked to answer the questionnaire independently, and their parents could not give any suggestions and comments. If the children had difficulties completing the survey, the researcher could read and explain the questions to the participants.

2.3. Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) (version 26; IBM, Armonk, NY, USA). Kolmogorov-Smirnov tests were used to determine the normality of data. Mean and SD were reported for normally distributed data, while median, range, skewness, and kurtosis were reported for non-normally distributed data. Independent *t*-test and Mann-Whitney test were performed for normally and non-normally distributed data, respectively. A Chi-Square test was used for gender comparison. A generalized linear model (GLM) was fitted to assess variables associated with the PREP 2 score. The outcome was the score of each of the 7 scales. The predictors included treatment (DISC lenses vs Single-vision spectacles) and gender as categorical variables, and three continuous variables, i.e., the participant’s age, duration of lens wear, and spherical equivalent refractive error. A *p*-value of < 0.05 was defined as statistically significant.

3. Results

A total of 110 participants were recruited for the study. Fifty-four children (49.1 %) were allocated to the DISC group and 56 (50.9 %) to the single-vision spectacles group according to the correction modalities. All the participants completed the Chinese version of the PREP 2 questionnaire and ocular examination. There were no statistically significant differences in any of the baseline demographics, refractive data, BCVA, and duration of lens wearing between the two groups ($P > 0.05$) (Table 1).

The observed PREP 2 scores for the DISC and single-vision spectacles groups are provided in Table 2. Five out of 7 scales of the differences in scores between the two groups were statistically significant (all $P < 0.05$), except for symptoms and handling ($P = 0.199, 0.815$, respectively). Participants wearing DISC lenses showed scores for vision, appearance, activities, peer perception, and overall that were significantly higher than those wearing single-vision spectacles (all $P < 0.05$). The improvement of vision-related quality of life in the DISC group was mainly represented in appearance and activities.

Results of the Generalized linear model indicated that sex, BCVA, spherical equivalent, and duration of lens wear did not affect the score in any PREP 2 scales, while treatment and age had statistically significant

Table 1
Characteristics of demographic and ocular data for participants.

	DISC group	single-vision spectacles group	P
Age, yrs*	9 (7–12)	9 (7–12)	0.822
Gender, male/female***	25/29	28/28	0.698
SE for right eye, D**	-2.42 ± 1.07	-2.56 ± 1.05	0.486
SE for left eye, D**	-2.45 ± 1.05	-2.47 ± 1.04	0.886
BCVA, LogMAR*	0.00 (-0.20–0.00)	0.00 (-0.20–0.00)	0.742
Duration of wearing lens, months*	10 (6–18)	12 (6–18)	0.203

SE, spherical equivalent; D, diopters; BCVA, best-corrected visual acuity; LogMAR, the logarithm of the minimal angle of resolution. Data are presented as median (range) for Age, BCVA and Duration of wearing lens, and as Mean ± SD for SE. *Mann-Whitney, **Independent *t*-test, ***Chi-Square test. single-vision spectacles.

Table 2
Comparison of PREP scale scores between the DISC and single-vision spectacles group.

	DISC group	single-vision spectacles group	P
Vision	78.13 (50–100), -0.31/-0.13	65.63 (50–93.75), 0.31/-0.03	< 0.001
Symptoms	71.88 (28.13–96.88), -0.97/3.12	71.88 (28.13–93.75), -0.77/0.34	0.199
Appearance	87.5 (56.25–100), -0.59/-0.15	67.19 (37.5–93.75), -0.21/-0.30	< 0.001
Activities	75 (37.5–96.88), -1.00/2.76	59.38 (9.38–81.25), -0.94/0.96	< 0.001
Handling	68.75 (37.5–100), -0.001/-0.06	73.44 (40.63–90.63), -0.49/-0.46	0.815
Peer perceptions	79.69 (43.75–100), -0.87/0.59	68.75 (28.13–96.88), -0.54/0.21	< 0.001
Overall	78.13 (46.88–100), -0.68/0.04	65.63 (37.5–100), 0.30/1.06	<0.001

Data are presented as median (range), skewness/kurtosis and p-values represent comparison between the DISC and single-vision spectacles group (Mann-Whitney test).

effects on the scores of at least one of the scales. There were no significant interactions between treatment and age for six scales, except for activities. Therefore, the models for these scales fitted with main effects are shown in Table 3.

The results indicated that the PREP 2 score adjusted for sex, spherical equivalent, BCVA, durations of lens wear, and interactions were significantly higher in the DISC group than the single-vision spectacles group by about 9.1 points for the vision scale ($P < 0.001$). The scores also increased by about 3.6 points with every additional year of age ($P < 0.001$).

The score was about 12.6 points higher for participants wearing contact lenses than spectacles in the peer perception scale ($P < 0.001$). For appearance and overall PREP 2 scales, the scores were significantly higher for DISC lenses wearers than single-vision spectacles wearers by about 17.0 and 10.5 points, respectively (both $P < 0.001$). Meanwhile, there was an age effect for these two scales regardless of treatment group, with about 2.7 points and 3.6 points higher scores for each

Table 3
Modeling of PREP 2 scales without significant interactions.

	Effect of treatment(95 %CI)	P	Age (increased per year) (95 %CI)	P
Vision	9.15 (5.92–12.38)	<0.001	3.59 (2.57–4.61)	<0.001
Symptoms	3.83 (-0.59–8.24)	0.089	2.31 (0.91–3.70)	0.001
Appearance	17.01 (12.83–21.18)	<0.001	2.77 (1.45–4.09)	<0.001
Handling	0.21 (-1.82–2.24)	0.837	6.70 (6.06–7.34)	<0.001
Peer perceptions	12.63 (7.44–17.82)	<0.001	1.48 (-0.16–3.12)	0.077
Overall	10.49 (6.83–14.15)	<0.001	3.65 (2.50–4.81)	<0.001

additional year of age, respectively (both $P < 0.001$).

As regard scales of symptoms and handling, the scores were not significantly different for DISC lenses wearers compared to spectacles wearers ($P = 0.089$, $P = 0.837$, respectively) after adjusting for sex, spherical equivalent, BCVA, durations of lens wear, and interactions. But the scores increased by about 2.3 points for symptoms scale ($P = 0.001$) and 6.7 points ($P < 0.001$) for handling scale with every increased year of age.

The interaction between treatment and age was statistically significant for the activities scale ($P < 0.05$). The scores for the activities scale were significantly higher in the DISC group than single-vision spectacles group, and the differences were greater for the older participants.

4. Discussion

The results of this study showed that Chinese children wearing DISC lenses reported better vision-related quality of life compared with those wearing single vision spectacles for most of the survey scales, especially in the areas of appearance, peer perception and activities. These findings could be attributed to the improvement of cosmetic appearance and the convenience of participating in activities provided by DISC lenses in comparison to spectacles.

With regards to the visual performance scale, better vision was reported with DISC lenses in this study, despite of the fact that there was no significant difference in BCVA between the two groups. This may reflect the observation, reported by several studies, that visual acuity is an unsatisfactory indicator of visual performance, and that subjective measures offer better sensitivity [24–26]. Nevertheless, reduced visual acuity and stability [27], or worse near vision [21], have been reported when wearing progressive or bifocal contact lenses, compared to single-vision spectacles, while other studies failed to find any significant difference for near vision [13,28]. These variable outcomes may be due to differences in the optical design of the contact lens, or other factors, such as misalignment with the pupil center.

There was no significant difference in daytime symptoms between the two groups in the current study. The results were similar to a previous report showing that symptoms did not differ between children wearing bifocal CLs and single-vision spectacles at 24 months follow-up, despite being significantly higher with the CLs at 12 months [21]. Other studies have reported a range of visual complications with bifocal and multifocal contact lens including positive dysphotopsia, altered contrast sensitivity, light disturbance, and poorer visual comfort scores compared to single-vision CLs [29,30]. Orthokeratology, however, is associated with fewer symptoms of dryness, itching, and burning compared to either soft CLs [31,32] or single-vision spectacles [16], perhaps because wear is limited to the hours of sleep.

It was noted from the symptom scales in the current study that scores increased by about 2.3 points with every additional year of age, regardless of different treatment. Walline et al. reported a similar improvement in older participants, speculating that better visual-related quality of life may be more obvious after ten years of age [15]. Clinical experience suggests that as children get older, they are able to avoid habits such as eye rubbing, and become less reactive to uncomfortable symptoms. These factors may be contributing to the age-related differences seen in the data.

The better performance on appearance, peer perception, activities and overall scores with DISC lenses in comparison with single-vision spectacles agreed with one previous study [21], and the improvements were greater in older children for the appearance and overall scores. Another study [14] using the Self-Perception Profile for Children, included physical appearance, athletic competence, and peer interactions components, and while this is a different kind of questionnaire to that used in the current study, the results were similar in finding advantages for contact lenses over spectacle. Likewise, improvements on these scales with OK CLs were shown by Yang et al. [28], and Santodomingo et al. [16] Presumably, it is the perceived enhancement of appearance and the convenience of engaging in activities without spectacles during the daytime that drives these outcomes. In contrast, Garcia et al. reported that the bifocal designed soft CLs worsened the satisfaction and psychometric visual-related quality compared to a single-vision CLs in the same material [30]. However, this assessment was made in adults, after only 25 min of wear, in dim-light conditions, which may explain the different results compared to the current study. Overall, it appears that contact lenses provide good visual performance and increase satisfaction with recreational activities and cosmetic appearance, especially among older children who are likely to pay more attention to these factors.

With regards to scales of handling, no significant differences were found between children wearing DISC lenses and single-vision spectacles, which disagreed with previous studies. Pomedá et al. surprisingly found that the rated score of handling with CLs was higher than spectacles in children, and they assumed the reason was the strong desire to use contact lenses for vision correction and enjoy the perceived convenience they provided [21]. A different study found lower handling scores with OK CLs than for spectacles; [28] a result which, while children and adolescents are reported to be competent and capable of independently managing contact lenses of all types (soft, daily disposable, rigid gas permeable and OK) [15,21,33–36], might be attributed to the strict care procedures required to maintain safety and avoid complications during wear [37]. Certainly, in the present study, enrolled participants wore DISC for 6 months without significant issues and handling scores improved by about 6.7 points per year of age, so it may not be so surprising that performance was not different between the two groups.

The current study had a retrospective design, and a prospective investigation would be preferable in future, to reduce the effects of recall bias. Since all the children wore their CLs or spectacles for 6–18 months and the visual-related quality of life stabilizes after 3 months [10], the current results are likely to reflect real-world VRQoL responses. On the other hand, visual performance among children with high myopia may differ from those with low to moderate myopia [38], so it would be useful to compare between these levels. Unfortunately, access to sufficient numbers of children with high myopia, who are wearing DISC lenses, was limited in this case, but this remains an interesting avenue for further study.

In conclusion, DISC lenses wear significantly improved the vision-related quality of life in Chinese children, compared with single-vision spectacles wear, for most of the survey scales, especially in the areas of appearance, peer perception and activities. The benefits provided by DISC lenses beyond efficacy in the retardation of myopia contribute to greater satisfaction than with single-vision spectacles for myopic children.

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Declaration of Competing Interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Morgan IG, French AN, Ashby RS, Guo X, Ding X, He M, et al. The epidemics of myopia: Aetiology and prevention. *Prog Retin Eye Res* 2018;62:134–49. <https://doi.org/10.1016/j.preteyeres.2017.09.004>.
- [2] Morgan IG, Wu P-C, Ostrin LA, Tideman JW, Yam JC, Lan W, et al. IMI Risk Factors for Myopia. *Invest Ophthalmol Vis Sci* 2021;62(5):3.
- [3] Flitcroft DI, He M, Jonas JB, Jong M, Naidoo K, Ohno-Matsui K, et al. IMI – Defining and Classifying Myopia: A Proposed Set of Standards for Clinical and Epidemiologic Studies. *Invest Ophthalmol Vis Sci* 2019;60(3):M20.
- [4] Dolgin E. The myopia boom. *Nature* 2015;519:276–8. <https://doi.org/10.1038/519276a>.
- [5] Brennan NA, Toubouti YM, Cheng Xu, Bullimore MA. Efficacy in myopia control. *Progress in Retinal and Eye Research* 2021;83:100923.
- [6] Bullimore MA, Ritchey ER, Shah S, Leveziel N, Bourne RA, Flitcroft DI. The risks and benefits of myopia control. *Ophthalmology* 2021;128:1561–79. <https://doi.org/10.1016/j.ophtha.2021.04.032>.
- [7] Cho P, Tan Q. Myopia and orthokeratology for myopia control. *Clin Exp Optom* 2019;102:364–77. <https://doi.org/10.1111/cxo.12839>.
- [8] Walline JJ, Bailey MD, Zadnik K. Vision-specific quality of life and modes of refractive error correction. *Optom Vis Sci* 2000;77:648–52. <https://doi.org/10.1097/00006324-200012000-00011>.
- [9] Walline JJ, Jones LA, Chitkara M, Coffey B, Jackson JM, Manny RE, et al. The Adolescent and Child Health Initiative to Encourage Vision Empowerment (ACHIEVE) study design and baseline data. *Optom Vis Sci* 2006;83(1):37–45.
- [10] Andersen C, Walline JJ. Validation of the pediatric refractive error profile2, American Academy of Optometry, 2012, <https://www.aaopt.org/det ail/knowledge-base-article/validation-pediatric-refractive-error-profile-2>.
- [11] Andersen C. Validation and Repeatability of Pediatric Refractive Error Profile 2 (PREP 2). The Ohio State University, 2013.
- [12] Han D, Gao M, Du B, Liu L, Liu Z, He M, et al. The Chinese version of the Pediatric Refractive Error Profile2 (PREP2): Translation, validation and reliability. *Contact Lens and Anterior Eye* 2022;101576.
- [13] Walline JJ, Gaume A, Jones LA, Rah MJ, Manny RE, Berntsen DA, et al. Benefits of contact lens wear for children and teens. *Eye Contact Lens* 2007;33(6):317–21.
- [14] Walline JJ, Jones LA, Sinnott L, Chitkara M, Coffey B, Jackson JM, et al. Randomized trial of the effect of contact lens wear on self-perception in children. *Optom Vis Sci* 2009;86(3):222–32.
- [15] Rah MJ, Walline JJ, Jones-Jordan LA, Sinnott LT, Jackson JM, Manny RE, et al. Vision specific quality of life of pediatric contact lens wearers. *Optom Vis Sci* 2010; 87(8):560–6.
- [16] Santodomingo-Rubido J, Villa-Collar C, Gilmartin B, Gutiérrez-Ortega R. Myopia control with orthokeratology contact lenses in Spain: a comparison of vision-related quality-of-life measures between orthokeratology contact lenses and single-vision spectacles. *Eye Contact Lens* 2013;39:153–7. <https://doi.org/10.1097/ICL.0b013e31827a0241>.
- [17] Aller TA, Liu M, Wildsoet CF. Myopia Control with Bifocal Contact Lenses: A Randomized Clinical Trial. *Optom Vis Sci* 2016;93:344–52. <https://doi.org/10.1097/OPX.0000000000000808>.
- [18] Anstice NS, Phillips JR. Effect of dual-focus soft contact lens wear on axial myopia progression in children. *Ophthalmology* 2011;118:1152–61. <https://doi.org/10.1016/j.ophtha.2010.10.035>.
- [19] Lam CSY, Tang WC, Tse D-Y-Y, Tang YY, To CH. Defocus Incorporated Soft Contact (DISC) lens slows myopia progression in Hong Kong Chinese schoolchildren: a 2-year randomised clinical trial. *Br J Ophthalmol* 2014;98:40–5. <https://doi.org/10.1136/bjophthalmol-2013-303914>.
- [20] Li S-M, Kang M-T, Wu S-S, Meng Bo, Sun Y-Y, Wei S-F, et al. Studies using concentric ring bifocal and peripheral add multifocal contact lenses to slow myopia progression in school-aged children: a meta-analysis. *Ophthalmic Physiologic Optic* 2017;37(1):51–9.
- [21] Pomedá AR, Pérez-Sánchez B, Cañadas Suárez MDP, Prieto Garrido FL, Gutiérrez-Ortega R, Villa-Collar C. MiSight Assessment Study Spain: A Comparison of Vision-Related Quality-of-Life Measures Between MiSight Contact Lenses and Single-Vision Spectacles. *Eye Contact Lens* 2018;44:S99–104. <https://doi.org/10.1097/ICL.0000000000000413>.
- [22] Jiang J. Expert consensus on myopia management white paper (2019). *Chinese Journal of Optometry Ophthalmology and Visual Science* 2019;21:161–5. <https://doi.org/10.3760/cma.j.issn.1674-845X.2019.03.001>.
- [23] The Group of Optometry, Society of Ophthalmology, Chinese Medical Association, Expert consensus on orthokeratology fitting process (2021), *Chinese Journal of Optometry Ophthalmology and Visual Science* 23 (2021) 1-5, <https://10.3760/cma.j.cn115909-20201201-00464>.
- [24] Papas EB, Decenzo-Verbeten T, Fonn D, Holden BA, Kollbaum PS, Situ P, et al. Utility of short-term evaluation of presbyopic contact lens performance. *Eye Contact Lens* 2009;35(3):144–8.
- [25] Diec J, Tilia D, Naduvilath T, Bakaraju RC. Predicting Short-term Performance of Multifocal Contact Lenses. *Eye Contact Lens* 2017;43:340–5. <https://doi.org/10.1097/ICL.0000000000000286>.
- [26] Jong M, Tilia D, Sha J, Diec J, Thomas V, Bakaraju RC. The relationship between visual acuity, subjective vision, and willingness to purchase simultaneous-image contact lenses. *Optometry Vision Sci* 2019;96:283–90. <https://doi.org/10.1097/OPX.0000000000001359>.

- [27] Chen S-T, Tung H-C, Chen Y-T, Tien C-L, Yeh C-W, Lian J-S, et al. The influence of contact lenses with different optical designs on the binocular vision and visual behavior of young adults. *Sci Rep* 2022;12(1).
- [28] Yang Bi, Ma X, Liu L, Cho P. Vision-related quality of life of Chinese children undergoing orthokeratology treatment compared to single vision spectacles. *Contact Lens Anterior Eye* 2021;44(4):101350.
- [29] Chamberlain P, Peixoto-de-Matos SC, Logan NS, Ngo C, Jones D, Young G. A 3-year Randomized Clinical Trial of MiSight Lenses for Myopia Control. *Optom Vis Sci* 2019;96:556–67. <https://doi.org/10.1097/OPX.0000000000001410>.
- [30] García-Marqués JV, Macedo-De-Araújo RJ, Cerviño A, García-Lázaro S, McAlinden C, González-Méjome JM. Comparison of short-term light disturbance, optical and visual performance outcomes between a myopia control contact lens and a single-vision contact lens. *Ophthalmic Physiol Opt* 2020;40:718–27. <https://doi.org/10.1111/opo.12729>.
- [31] Lipson MJ, Sugar A, Musch DC. Overnight corneal reshaping versus soft daily wear, A visual quality of life study (interim results). *Eye Contact Lens* 2004;30:214–7. <https://doi.org/10.1097/01.icl.0000140236.23820.97>.
- [32] Lipson MJ, Sugar A, Musch DC. Overnight corneal reshaping versus disposable contact lenses: vision related quality-of-life differences from a randomized clinical trial. *Optom Vis Sci* 2005;82:886–91. <https://doi.org/10.1097/01.opx.0000180818.40127.dc>.
- [33] Katz J, Schein OD, Levy B, Cruiscullo T, Saw S-M, Rajan U, et al. A randomized trial of rigid gas permeable contact lenses to reduce progression of children's myopia. *Am J Ophthalmol* 2003;136(1):82–90.
- [34] Li L, Moody K, Tan DT, Yew KC, Ming PY, Long QB. Contact lenses in pediatrics study in Singapore. *Eye Contact Lens* 2009;35:188–95. <https://doi.org/10.1097/ICL.0b013e3181abb5bb>.
- [35] Cho P, Cheung SW, Edwards M. The longitudinal orthokeratology research in children (LORIC) in Hong Kong: A pilot study on refractive changes and myopic control. *Curr Eye Res* 2005;30:71–80. <https://doi.org/10.1080/02713680590907256>.
- [36] Horner DG, Soni PS, Salmon TO, Swartz TS. Myopia progression in adolescent wearers of soft contact lenses and spectacles. *Optom Vis Sci* 1999;76:474–9. <https://doi.org/10.1097/00006324-199907000-00023>.
- [37] Cho P, Cheung SW, Mountford J, White P. Good clinical practice in orthokeratology. *Cont Lens Anterior Eye* 2008;31:17. <https://doi.org/10.1016/j.clae.2007.07.003>.
- [38] Liou SW, Chiu CJ. Myopia and contrast sensitivity function. *Curr Eye Res* 2001;22: 81–4. <https://doi.org/10.1076/ceyr.22.2.81.5530>.