Observational Study

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Spectacle-wearing compliance and its associated determinants among infants with bilateral corrective refractive errors

An observational study

Xiaoyan Li, MB[a], Xiaoshan Lin, MB[b], Jinzhu Tang, MB[b], Guifang Hu, PhD[a,*]

Abstract

This study aimed to evaluate spectacle-wearing compliance and identify the determinants associated with it in infants with bilateral corrective refractive errors. Infants aged < 3 years with bilateral corrective refractive errors who were supplied with spectacles for > 1 month were enrolled at the pediatric comprehensive clinic of Zhongshan Ophthalmic Center. Spectacle-wearing compliance was evaluated by calculating the percentage of spectacle-wearing time in the awake time (STIT), and its potential determinants were identified based on interviews with the infants' caregivers using univariate and multivariate logistic regression analysis. Pearson correlation analysis was performed to further determine the degree of correlation between spectacle-wearing compliance and weight of spectacles. A total of 366 infants (age: 20.85 ± 9.06 months, male: 54.92%) were included. The mean percentage of STIT was 64.00%±41.69%. The communication between caregivers of different infants regarding spectacle-wearing experience (P = .004, OR = 2.290, 95% confidence interval [CI] for OR = 1.301–4.029), perceptions of spectacle-wearing importance (P = .000, OR = 6.337, 95% CI for OR = 3.664–10.961), and weight of spectacles (P = .000, OR = 7.271, 95% CI for OR = 4.141–12.769) were significantly associated with spectacle-wearing compliance. Besides, spectacle-wearing compliance was positively correlated with the weight of spectacles (P < .01), exhibiting a decreasing trend with the weight of spectacles. Overall, spectacle-wearing compliance requires improvement. Moreover, efficient strategies aimed at improving spectacle-wearing compliance, such as enhancing communication between caregivers of different infants regarding spectacle-wearing experience, raising awareness about the importance of wearing spectacles, and reducing the weight of spectacles, are urgently needed.

Abbreviations: STIT = spectacle-wearing time in the awake time, ZOC = Zhongshan Ophthalmic Center.

Keywords: infant, questionnaire interview, refractive correction, refractive errors, spectacle-wearing compliance

1. Introduction

Uncorrected refractive errors are the leading cause of moderate-to-severe vision impairment and the second most common cause of blindness worldwide.[1,2] The infantile period is a critical period for visual development, and high refractive errors without prompt treatment in this period may lead to amblyopia, resulting in permanent vision loss if not corrected early.[3,4] Therefore, refractive correction in the infantile period is urgently needed.

Most refractive errors during infancy can be treated with appropriate refractive correction using spectacles or contact lenses.[5–7] Among these refractive correction strategies, spectacle wearing is the most cost-effective intervention and the most appropriate treatment for refractive errors in developing countries.[8,9] Particularly, good spectacle-wearing compliance can improve the effect of refractive correction and help infants with refractive errors avoid amblyopia due to a lack of visual stimulation.[10] A previous study assessed the association with age and compliance of spectacle wearing among aphakic infants with congenital cataracts who underwent lens extraction and showed that compliance with spectacle wear was low during the earlier stage, but increased with time in aphakic infants.[11] Therefore, efficient strategies aimed at improving spectacle-wearing compliance are needed. A recent

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

All appropriate research documents were reviewed and approved by the Independent Ethics Committee of ZOC. Before the questionnaires were administered, each caregiver was given information about the interview, and informed consent was obtained from each infant before the interview.

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systematic review and meta-analysis demonstrated that free spectacles have significant effect on compliance among children and concluded that the combination of providing free spectacles along with educational interventions can lead to high levels of compliance among the study participants.[12] However, studies on spectacle-wearing compliance in infants with refractive errors complicated by different eye diseases are lacking.

As spectacle-wearing compliance in infants with different diseases has remained unexplored,[13–16] we conducted this cross-sectional study at Zhongshan Ophthalmic Center (ZOC) to evaluate spectacle-wearing compliance and identify related factors that might affect spectacle-wearing compliance. Our findings would provide guidance for improving spectacle-wearing compliance and be of clinical significance to refractive correction.

2. Methods

2.1. Patients

The study was performed from June 2020 to August 2021 at the pediatric comprehensive clinic of ZOC, a tertiary specialized hospital in Guangzhou, China, according to the ethical principles described in the Declaration of Helsinki. All appropriate research documents were reviewed and approved by the Independent Ethics Committee of ZOC. Before the questionnaires were administered, each caregiver was given information about the interview, and consent was obtained from them before the interview.

The patients enrolled in this study were aged < 3 years and had refractive errors that required correction. A pair of spectacles corrected for refractive error were administered to infants for > 1 month. The exclusion criteria were physical or mental disorders, lack of consent, and failure to complete the interview.

2.2. Data collection

The infants' caregivers were interviewed using a designed questionnaire shown in Data S1, Supplemental Digital Content, http://links.lww.com/MD/K922. All questions were modified to ensure that they were understandable, and reliable answers were obtained in a pilot study (56 infants in 2019). The interviews were conducted by an experienced interviewer to ensure that the caregivers were aware of the questions.

2.3. Evaluation of spectacle-wearing compliance

Spectacle-wearing compliance was evaluated by calculating the percentage of spectacle-wearing time in the awake time (STIT), and the total weight of spectacles was measured using the same weighing machine (AMX, KFJ-A). Good spectacle-wearing compliance was defined as the percentage of STIT > 90%.

2.4. Statistical analysis

The recorded data were reviewed for accuracy and analyzed by 2 researchers. Categorical data were described as frequency (%). The associations between the questions and spectacle-wearing compliance were examined using univariate logistic regression and the significance level was set at $P < .1$. The relationship between the significant factors identified and spectacle-wearing compliance was further estimated using multivariate logistic regression, with $P < .05$ considered statistically significant. Moreover, a Pearson correlation analysis was performed to further determine the degree of correlation between spectacle-wearing compliance and weight of spectacles.

3. Results

3.1. Basic eye conditions of the included infants

From January 2021 to October 2021, we recruited 392 infants who met our inclusion criteria. Among these, 366 infants' caregivers (93.37%) agreed to participate and successfully completed the questionnaire. In total, data were collected for 201 (54.9%) males and 165 (45.1%) females for analysis, and the mean age (±standard deviation) was 20.85 ± 9.06 months. The distribution of eye conditions among the included infants is shown in Figure 1. Among the 366 infants included in our study, 31% (112) had congenital cataract, 31% (112) had simple refractive errors, 17% (64) had congenital glaucoma, 14% (52) had fundus disease (including lesions of the retina, optic papilla, macula and central retinal artery), 4% (14) had corneal disease, and 3% (12) had chromosome anomaly syndrome (including Down syndrome, Turner syndrome, Marfan syndrome etc.). The mean percentage of STIT was 64.00% ± 41.69%. In details, the mean percentage of STIT was 69.64% in infants with congenital cataract, 68.75% in infants with simple refractive error, 48.43% in infants with congenital glaucoma and 53.85% in fundus disease (Fig. 2). As shown in Table 1, 62.19% of infants had good spectacle-wearing compliance.

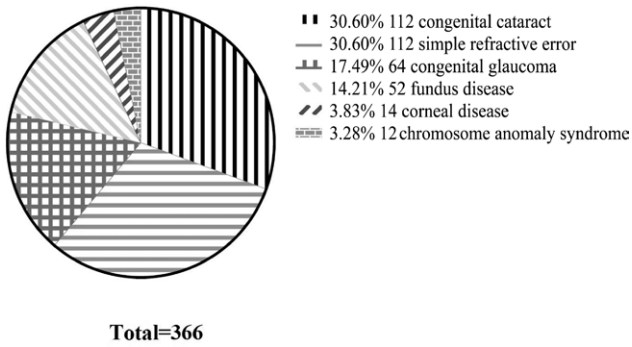

Figure 1. Distribution of the included infants with different diseases.

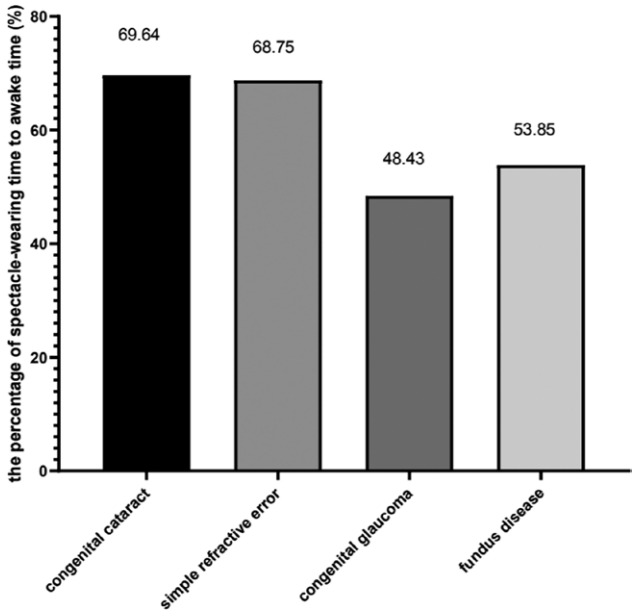

Figure 2. Percentage of spectacle-wearing time in the awake time under different eye conditions.

3.2. Analysis of factors affecting the spectacle-wearing compliance

Single- and multi-factor analyses were conducted to investigate the relationship between the spectacle-wearing compliance and factors potentially affecting it. As shown in Table 2, 5 variables were statistically significant in univariate analysis: disease type, knowledge of amblyopia therapy, communication regarding spectacle wearing, perceptions of the importance of wearing spectacles, and weight of spectacles ($P < .1$). Moreover, multivariate logistic regression correlation analysis was performed to evaluate the association between the 5 significant factors and spectacle-wearing compliance, which revealed that 3 factors were statistically correlated with spectacle-wearing compliance, namely, communication regarding spectacle wear ($P = .004$, OR = 2.290, 95% confidence interval [CI] for OR = 1.301–4.029), perceptions of spectacle-wearing importance ($P = .000$, OR = 6.337, 95% CI for OR = 3.664–10.961), and weight of spectacles ($P = .000$, OR = 7.271, 95% CI for OR = 4.141–12.769).

3.3. Correlation between spectacle-wearing compliance and weight of spectacles

To further determine the degree of correlation between spectacle-wearing compliance and weight of spectacles, a Pearson correlation analysis was performed. In Figures 3 and 4, the X-axis represents the weight of spectacles and the Y-axis represents the percentage of STIT. The regression lines were created based on linear regression, and the corresponding amount of variance (R^2) was accounted for by the linear relationship. The results indicated that spectacle-wearing compliance was positively correlated with the weight of spectacles when the other related factors were considered as control factors in all included infants ($P = .004$, Fig. 3; $P = .000$, Fig. 4), exhibiting a decreasing trend with the weight of spectacles. The relationship indicated by R^2 between 2 variables in the group with spectacles weighing 20–30 g ($R^2 = 0.615$) was stronger than that in the group with spectacles weighing 10–20 g ($R^2 = 0.033$).

Table 1

Distribution of proportion (the percentage of spectacle-wearing time in the awake time) in the questionnaire.

Proportion	Number of infants
Proportion ≥ 0.9	227 (62.02%)
0.7 ≤ proportion < 0.9	11 (3.01%)
0.5 ≤ proportion < 0.7	31 (8.47%)
0.3 ≤ proportion < 0.5	6 (1.64%)
0.1 ≤ proportion < 0.3	58 (15.85%)
Proportion < 0.1	33 (9.02%)
Total	366 (100%)

Table 2

Analysis of factors affecting the spectacle-wearing compliance.

Factors	P_1	P_2	OR	95% CI for OR	
				Lower	Upper
1. Disease type	**.071**				
2. Sex	.896	–	–	–	–
3. Age in the questionnaire	.491	–	–	–	–
4. Knowledge of treatment plan	.384	–	–	–	–
5. Knowledge of amblyopia therapy	**.048**	–	–	–	–
6. Communication regarding spectacle wearing	**.052**	.004	2.290	1.301	4.029
7. Educational background of guardian	.259	–	–	–	–
8. Perceptions regarding the importance of wearing spectacles	**.000**	.000	6.337	3.664	10.961
9. Softness of spectacle frame	.318	–	–	–	–
10. Weight of spectacles	**.000**	.000	7.271	4.141	12.769
11. Degree of lens scratches	.611	–	–	–	–
12. Spectacle tightness	.636	–	–	–	–
13. Dirt resistance of the lens	.502	–	–	–	–

P_1: significance at $P_1 < .1$ in univariate logistic regression analysis. P_2: significance at $P_2 < .05$ in multivariate logistic regression.

4. Discussion

Uncorrected refractive errors are among the most common factors leading to visual impairment worldwide.[17,18] The critical period of human visual development is between birth and approximately 3 years of age.[10] There is an urgent need for infants with refractive errors to wear spectacles for refractive correction. This is the first study to evaluate spectacle-wearing compliance and potential related factors that might affect the compliance in infants with refractive errors with different eye diseases. The results of our study would be of clinical significance to refractive correction, involving enhancing communication

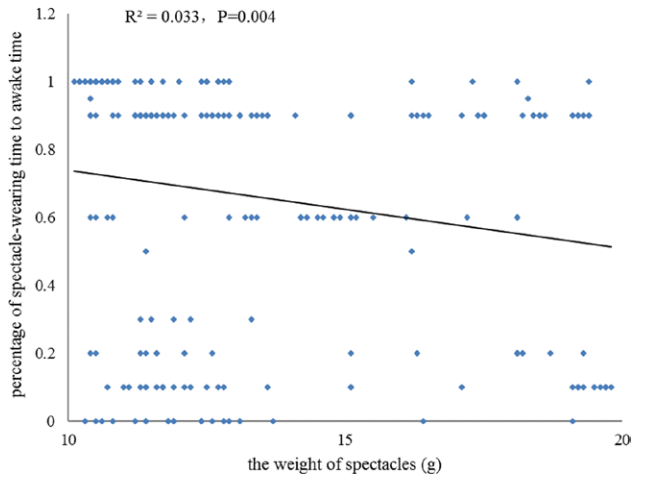

Figure 3. Pearson correlation analysis between the weight of spectacles and percentage (spectacle-wearing time in the awake time) in the group with spectacles weighing 10–20 g.

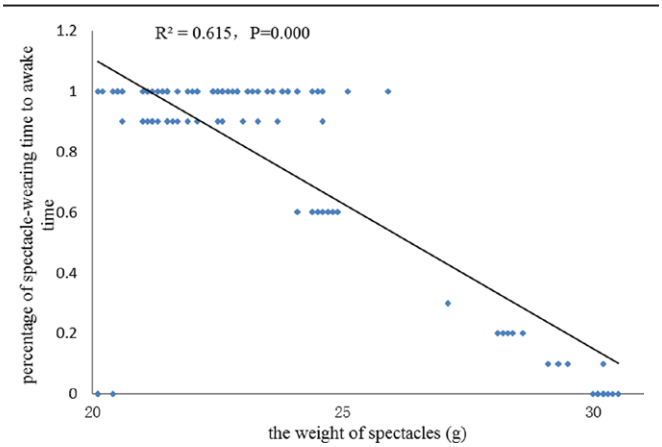

Figure 4. Pearson correlation analysis between the weight of spectacles and percentage (spectacle-wearing time in the awake time) in the group with spectacles weighing 20–30 g.

regarding spectacle wearing, increasing the perceptions regarding the importance of wearing spectacles, and reducing the weight of spectacles.

Communication regarding spectacle wearing between caregivers of different infants has been considered an important factor that affects the spectacle-wearing compliance. Communication with caregivers which have rich experiences can enhance the caregivers' understanding regarding the importance of wearing spectacles and increases their attentiveness to spectacle-wearing behaviors. Similar results were reported in our previous study on aphakic infants with congenital cataracts who underwent lens extraction, with better spectacle-wearing compliance, calling for more communication about spectacle wearing with other caregivers of different infants. Additionally, perceptions of spectacle-wearing importance have long been considered as another important psychological factor that affects spectacle-wearing compliance. For infants, the caregivers occupy the dominant position in their daily lives and can even alter the daily behavior of infants; therefore, the success of spectacle-wearing compliance depends heavily on the caregivers' perceptions of the importance of wearing spectacles. However, for children aged > 3 years, the decisions are often made by themselves but not by their caregivers in their daily lives; therefore, their spectacle-wearing compliance depends heavily on self-related factors.[19–25]

In this study, a lower spectacle weight contributed to better spectacle-wearing compliance, especially in the group of spectacles weighing 20–30 g. The highest correlation coefficient (OR = 7.271, $P < .001$) between the weight of spectacles and spectacle-wearing compliance demonstrated that the weight of spectacles is a crucial factor that may influence spectacle-wearing compliance. The weight of spectacles is a relatively controllable factor that allows ophthalmologists to provide significant clinical guidance for refractive correction. In this study, a Pearson correlation analysis was performed to identify the correlation between the weight of spectacles and spectacle-wearing compliance in the 2 weight groups. The results demonstrated that the weight of spectacles was positively correlated with spectacle-wearing compliance in both groups (20–30 g: $R^2 = 0.615$, $P = .000$; 10–20 g: $R^2 = 0.003$, $P = .004$); as such, a lower spectacle weight was associated with better spectacle-wearing compliance. The linear trend between the weight of spectacles and spectacle-wearing compliance confirms the importance of a lower spectacle weight, especially in the group of spectacles weighing 20–30 g.

Due to the impact of vision impairment caused by uncorrected refractive errors, interventions are urgently needed. Benefiting from this study, 3 interventions can be performed: improving the caregivers' awareness regarding the importance of wearing spectacles, enhancing communication about wearing spectacles, and reducing the weight of spectacles. Moreover, social media applications such as WeChat or QQ in China may provide a platform for caregivers to communicate about their spectacle-wearing experiences. In addition, ophthalmologists and optometrists should be encouraged to pay more attention to spectacle-wearing compliance in infants with refractive errors and provide more lectures to increase the caregivers' awareness regarding the importance of wearing spectacles. Moreover, methods to reduce the weight of spectacles should be implemented to improve spectacle-wearing compliance.

A limitation of our study was the uneven distribution of the included infants with different diseases. Furthermore, data on uncorrected visual acuity and best-corrected visual acuity were not available because the infants had difficulty cooperating with visual acuity testing. Congenital cataract and simple refractive errors both accounted for 30.60% (112) of cases, corneal disease accounted for 3.83%, and syndrome disease accounted for 3.28%. The ability to improve corrected visual acuity varies among disease categories, for example, the eye conditions that have a strong ametropic element are related to a better compliance while the congenital glaucoma and fundus diseases are less likely to motivate the children to wear their glasses as the best corrected visual acuity is not expected to be much better than the uncorrected. In general, infants who were corrected for best visual acuity had better spectacle-wearing compliance than those with poor corrected visual acuity. However, fewer data were available for naked-eye visual acuity and best-corrected visual acuity when only the Teller test was available for infants in whom visual inspection was difficult.

5. Conclusion

In summary, spectacle-wearing compliance remains unsatisfactory. Furthermore, efforts aimed at enhancing communication on wearing spectacles, increasing the caregivers' awareness regarding the importance of wearing spectacles, and reducing the weight of spectacles may contribute to improving spectacle-wearing compliance.

Author contributions

Conceptualization: Xiaoyan Li, Guifang Hu.
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Writing – original draft: Xiaoyan Li.
Writing – review & editing: Guifang Hu.

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