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ORIGINAL RESEARCH

Decision Behavior and Influential Factors of Spectacle Prescription for Schoolchildren in Taiwan

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Purpose: The prevalence of children myopia in Taiwan is among the highest in the world. The study aimed to understand the status of the final prescription of the spectacle prescribed by the Taiwan optometrists when they conducted the visual inspection of elementary school, middle school and high school students, and to evaluate the influencing factors of their decision-making behavior.

Methods: Among the attendants of the continuing education course activities held by optometrist associations in Taiwan, an anonymous questionnaire survey was given on the spot to optometrists who have passed the national examination. This study received 442 questionnaire surveys, including 174 optometrists and 268 assistant optometrists. The data were analyzed by using chi-square test in IBM SPSS.

Results: There are statistically significant differences in the decision-making of spectacle prescription for myopia of −1.00D~−1.50D and −2.25D~−2.50D in the primary school stage between optometrists and assistant optometrists. There are also significant differences for myopia of −2.25D and above in the middle school students. By the time of high school, there are significant differences for myopia from −0.75D to −3.25D and above. The higher the grade, the greater the difference in the final prescription of the spectacles given. As for the judgment factors of the final prescription, only children among elementary school and junior high school show a statistically significant difference in professional judgment between optometrists and assistant optometrists. There is no significant difference in the judgment factors for high school children. Depending on the educational level of optometrists and assistant optometrists and their distribution area, the prescription decisions are also different.

Conclusion: The optometrists prefer to prescribe full correction for schoolchildren, while the assistant optometrists mostly prescribe under-correction in prescriptions for low-degree myopia and lower grades. Further investigation is needed to study its impact on children's visual health.

Keywords: children myopia, optometrists, assistant optometrists, prescription

Introduction

Taiwan has one of the highest myopia prevalence in the world, especially for children, where the weighted prevalence is 25.41% for 7-year-olds and to 76.67% for 12-year-olds,[1] Once myopia starts in children and teenagers, it is difficult to control from getting worse. The continuous increase in myopia not only causes inconvenience in daily life but also leads to complications in the future. Recent evidence-based studies have also confirmed that the time spent outdoors is a crucial protective factor in delaying the onset of myopia.[2]

The prevalence of myopia among young people is rising globally, particularly among 6 to 10-year-olds who experience an average yearly increase of −1.00D to −1.25D.This increase is likely due to the widespread use of technology such as smartphones and prolonged screen viewing, which causes eye strain and increases the likelihood of vision problems and myopia.[3,4]

In Taiwan, some ophthalmologists advocate for the use of atropine, with 60% of Taiwanese children using it.[5] Treatment by pediatric ophthalmologists can reduce the progression of myopia, with multiple interventions reducing its development. Atropine 0.01% is reportedly the most popular and safe treatment.[6] Many methods exist to correct myopia, but their efficacy varies. Studies have shown that the daily use of DIMS lenses can significantly delay the

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progression and axial growth of myopic children, while only 7.4% of children with SV lenses had no myopia progression in 2 years.[7] Preventing the worsening of myopia in school-aged children and finding effective ways to control it are valuable research topics.[6,8]

A recent survey of 940 global ophthalmologists found that 8.2% prescribe under-correction for myopia as a control strategy.[6] The study aimed to understand the status of the final prescription of the spectacle prescribed by the Taiwan optometrists when they conducted the visual inspection of elementary school, middle school and high school students, and to evaluate the influencing factors of their decision-making behavior.

Methods

This study surveyed qualified optometrists and assistant optometrists in the country through a questionnaire. Participants were included if they passed the national exam and excluded if they did not. The original plan was to conduct 1600 surveys, but due to the COVID-19 pandemic, the number was reduced to 442, with 174 from optometrists and 268 from assistant optometrists.

The questionnaire included professional judgment on lens prescription for primary, junior high, and high school students who were diagnosed with myopia by ophthalmologists. It also asked about prescription options, including full correction, under-correction (reducing spherical or cylindrical), prescription differences, and factors affecting decision-making (initial wearing, distance demand, parent request, and professional judgment).

The questionnaire was reviewed and revised by three expert scholars for relevance, accuracy, and suitability. The study was approved by the regional ethics committee of China Medical University. We confirm that all participants had provided informed consent. The collected surveys were analyzed using Student's *t*-test and chi-square test to determine the association between optometrists' decision-making and prescription differences for different levels of students and the factors affecting their decisions. Statistical significance was considered as a P-value < 0.05.

Results

The characteristics of the participants are summarized in Table 1.Optometrists with mean (SD) age of 41.14(10.01) years and assistant optometrists with mean (SD) age of 43.11(10.06) years, the difference was statistically significant (P =0.002).The proportion of males to females among the 174 optometrists is 118 (67.8%) to 56 (32.2%) respectively. Among the 268 assistant optometrists, the proportion of males to females is 154 (57.5%) to 114 (42.5%) respectively.

Table 1 Demographics of Optometrists and Assistant Optometrists

	Optometrists (N=174) n (Percentage)	**Assistant Optometrists (N=268) n (Percentage)**	**P**
Gender (M/F)	118/56	154/114	0.029*
Age (yr)			0.002*
20–25	16 (9.2%)	4 (1.5%)	
26–30	15 (8.6%)	30 (11.2%)	
31–35	24 (13.8%)	30 (11.2%)	
36–40	26 (14.9%)	58 (21.6%)	
41–45	30 (17.2%)	32 (11.9%)	
46–50	29 (16.7%)	39 (14.6%)	
51–55	23 (13.2%)	41 (15.3%)	
56–60	9 (5.2%)	27 (10.1%)	
Over 61	2 (1.1%)	7 (2.6%)	
Experience (yr)			0.149
1–5	31 (17.8%)	29 (10.8%)	
6–10	34 (19.5%)	51 (19.0%)	

(*Continued*)

Table 1 (Continued).

	Optometrists (N=174) n (Percentage)	Assistant Optometrists (N=268) n (Percentage)	P
11–15	23 (13.2%)	43 (16.0%)	
16–20	35 (20.1%)	51 (19.0%)	
21–25	25 (14.4%)	29 (10.8%)	
26–30	20 (11.5%)	39 (14.6%)	
31–35	3 (1.7%)	13 (4.9%)	
36–40	2 (1.1%)	10 (3.7%)	
41–45	1 (0.6%)	3 (1.1%)	
Education			<0.001*
Junior high	0 (0%)	3 (1.1%)	
Senior high	2 (1.2%)	96 (35.8%)	
College	82 (47.1%)	112 (41.8%)	
Bachelor	83 (47.7)	55 (20.5%)	
Graduate school	7 (4.0%)	2 (0.8%)	

Note: *Statistically significant with p-value <0.05.

Both groups show a similar trend with a higher proportion of males compared to females. Comparing the rates of gender between optometrists and assistant optometrists revealed a significant difference (P=0.029) (Table 1).

The professional judgement data analysis of optometrists and assistant optometrists on the disposal of final lens prescription obtained after examining elementary school children is shown in Table 2. There is a statistically significant difference in the choice of full correction lens or under-correction lens between the two groups, with optometrists tending

Table 2 Comparison of Decision Making on Elementary School Students

Myopia	Optometrists (N=174) n (Percent)	Assistant Optometrists. (N=268) n (Percent)	P
−0.25~−0.75D			0.086
Full correction Under-correction Un-correction w. follow up	38 (21.8%) 5 (2.9%) 131 (75.3%)	39(14.6%) 14(5.2%) 215 (80.2%)	
−1.00~−1.50D			0.004*
Full correction Under-correction Un-correction w. follow up	98(56.3%) 44(25.3%) 32(18.4%)	121(45.1%) 109(40.7%) 38(14.2%)	
−1.75~−2.00D			0.07
Full correction Under-correction Un-correction w. follow up	125 (71.9%) 48(27.5%) 1(0.6%)	153 (57.1%) 111 (41.4%) 4 (1.5%)	
−2.25~−2.50D			
Full correction Under-correction Un-correction w. follow up	141(81%) 33(19%) 0(0%)	180(67.2%) 87 (32.5%) 1 (0.3%)	0.05

(*Continued*)

Table 2 (Continued).

Myopia	Optometrists (N=174) n (Percent)	Assistant Optometrists. (N=268) n (Percent)	P
−2.75~−3.00D			0.09
Full correction Under-correction Un-correction w. follow up	143(82.2%) 31(17.8%) 0(0%)	186(69.5%) 81(30.2%) 1(0.3%)	
−3.25D and above			0.08
Full correction Under-correction Un-correction w. follow up	145 (83.3%) 29 (16.7%) 0 (0%)	189(70.5%) 78(29.5%) 1 (0.3%)	
Factor of decision-making			
First-time wearer Location of prescription Parent's request Professional judgment	116 (66.7%) 90(51.7%) 42(24.1%) 149(85.6%)	180 (67.2%) 160(59.7%) 53(19.8%) 202(75.4%)	0.913 0.098 0.275 0.009*

Note: *Statistically significant with p-value <0.05.

to choose full correction lenses and assistant optometrists tending to choose under-correction lenses, particularly in the cases of myopia of −1.00~−1.50D (P=0.004) and myopia of −2.25D~−2.50D (P=0.05) (Table 2).

The statistical analysis of the professional judgement data on how to dispose the final prescription for glasses after examining Junior high school students, as shown in Table 3, reveals significant differences in prescription levels −2.25 to −2.50D (P=0.017), −2.75 to −3.00D (P=0.005), and −3.25D or higher (P=0.01). Optometrists tend to choose full correction glasses more frequently than assistant optometrists, who choose under-correction glasses more frequently.

Table 3 Comparison of Decision Making on Junior High School Students

Myopia	Optometrists (N=174) n (Percent)	Assistant Optometrists (N=268) n (Percent)	P
−0.25~−0.75D			0.311
Full correction Under-correction Un-correction w. follow up	46(26.4%) 20(11.5%) 108(62.1%)	54(21.0%) 34(12.6%) 178(66.4%)	
−1.00~−1.50D			0.440
Full correction Under-correction Un-correction w. follow up	108(62.1%) 58(33.3%) 8(4.6%)	134(50.0%) 119(44.4%) 15(5.6%)	
−1.75~−2.00D			0.066
Full correction Under-correction Un-correction w. follow up	130(74.7%) 42(24.1%) 2(1.2%)	172(64.1%) 91(34.0%) 5(1.9%)	

(*Continued*)

Table 3 (Continued).

Myopia	Optometrists (N=174) n (Percent)	Assistant Optometrists (N=268) n (Percent)	P
−2.25~−2.50D			0.017*
Full correction Under-correction Un-correction w. follow up	142(81.6%) 32(18.4%) 0(0%)	187(69.8%) 80(29.9%) 1(0.3%)	
−2.75~−3.00D			0.005*
Full correction Under-correction Un-correction w. follow up	144(82.8%) 30(17.2%) 0(0%)	185(69.0%) 82(30.7%) 1(0.3%)	
−3.25D and above			0.010*
Full correction Under-correction Un-correction w. follow up	145(83.3%) 29(16.7%) 0(0%)	190(70.9%) 77(28.8%) 1(0.3%)	
Factor of decision-making			
First-time wearer Location of prescription Parent's request Professional judgment	113(64.9%) 95(54.6%) 34(19.5%) 151(86.8%)	166(61.9%) 158(59.0%) 48(18.0%) 201(75.0%)	0.523 0.366 0.667 0.003*

Note: *Statistically significant with p-value <0.05.

After checking the high school students' vision, the results showed that optometrists prescribe full correction lenses more often than assistant optometrists regardless of the degree of myopia, while assistant optometrists prescribe under-correction lenses more often than optometrists with a statistically significant difference (all P<0.05) (Table 4).

Table 4 Comparison of Decision Making on Senior High School Students

Myopia	Optometrists (N=174) n (Percent)	Assistant Optometrists (N=268) n (Percent)	P
−0.25~−0.75D			0.034*
Full correction Under-correction Un-correction w. follow up	60(34.5%) 31(17.8%) 83(47.7%)	67(25%) 40(14.9%) 161(60.1%)	
−1.00~−1.50D			0.029*
Full correction Under-correction Un-correction w. follow up	113(64.9%) 52(29.9%) 9(5.2%)	146(54.5%) 114(42.5%) 8(3.0%)	
−1.75~−2.00D			0.005*
Full correction Under-correction Un-correction w. follow up	144(82.8%) 29(16.7%) 1(0.5%)	186(69.4%) 81(30.2%) 1(0.4%)	

(*Continued*)

Table 4 (Continued).

Myopia	Optometrists (N=174) n (Percent)	Assistant Optometrists (N=268) n (Percent)	P
−2.25~−2.50D			0.003*
Full correction Under-correction Un-correction w. follow up	148(85.1%) 26(14.9%) 0(0%)	196(73.1%) 72(26.9%) 0(0%)	
−2.75~−3.00D			0.013*
Full correction Under-correction Un-correction w. follow up	146(83.9%) 28(16.1%) 0(0%)	198(73.9%) 70(26.1%) 0(0%)	
−3.25D and above			0.02*
Full correction Under-correction Un-correction w. follow up	145(83.3%) 29(16.7%) 0(0%)	198(73.9%) 70(26.1%) 0(0%)	
Factor of decision-making			
First-time wearer Location of prescription Parent's request Professional judgment	104(59.8%) 92(52.9%) 23(13.2%) 154(88.5%)	161(60.0%) 156(58.2%) 40(14.9%) 219(81.7%)	0.949 0.269 0.616 0.055

Note: *Statistically significant with p-value <0.05.

The optometrists and assistant optometrists both show similar opinions statistically in their assessment of under-correction with correction primarily based on reduction in spherical diopter (−0.25D, −0.50D, −0.75D) and under-correction with correction primarily based on reduction in cylindrical diopter (−0.25D, −0.50D, −0.75D) (Table 5).

Table 5 Clinical Characteristics of Under-Correction

Reduce	Optometrists (N=174) n (percent)	Assistant Optometrists (N=268) n (percent)	p 0.099
Spherical Cylinder	118(68%) 56(32%)	162(60%) 106(40%)	
Spherical			0.488
−0.25D −0.50D −0.75D Total	82(47%) 34(20%) 2(1%) 118	121(45%) 40(15%) 1(0.3%) 162	
Cylinder			0.318
−0.25D −0.50D −0.75D	40(23%) 16(9%) 0(0%)	64(24%) 41(15%) 1(0.3%)	
Total	56	106	

Discussion

Research has demonstrated that children's exposure to outdoor environments can reduce the incidence of myopia, without the need for physical activity. Simply being outside the classroom has a preventive effect.[9] Outdoor activities can slow axial elongation and lower the risk of myopia.[10] Outdoor activities are one of the most important environmental factors in controlling myopia.

Torii et al reported that violet light (VL, with a wavelength of 360–400nm) can suppress the progression of myopia.[11] Hua et al aimed to determine if higher light levels in rural classroom can protect school-aged children from myopia or its progression by examining 1713 students aged 6–14 from four schools in Northeast region, with 317 participants in the study. The study found that improving the median illuminance of blackboards and desks, as well as desk lighting uniformity, reduced the incidence of new myopia onset by 4% compared to 10% in the control group (p=0.029). The results showed that elevated light levels in classrooms have a significant impact on myopia onset, refraction, and axial growth.[12]

Many factors contribute to the cause of myopia and its progression, including close-up work,[13] Lack of outdoor activities,[14] Asian,[15] high education, Parents with myopia, low Serum 25-Hydroxyvitamin D,[16] even allergic conjunctivitis.[17]

Taiwan has been proven to be one of the countries with the highest rates of myopia in the world. Most elementary students spend more than 12 hours a day on homework and learning skills to cope with the intense academic pressure. Compared to other regions, this prolonged near-distance visual work may be a significant factor contributing to the high incidence of myopia among Taiwanese students.[18] Preventing the development of high myopia during childhood to reduce the impact and inconvenience on quality of life and decrease the incidence of myopia complications is the primary goal in controlling its progression.

Conclusions

Optometrists primarily prescribe full correction for school-aged children. Assistant optometrists tend to prescribe under correction for low degree myopia and for lower grades. Additionally, collecting more parameters, such as presence of anisometropia, for the final decision-making on eyeglass prescription, could provide more conclusive results. Further studies are needed to evaluate the impact on visual health caused by the difference in the choice between optometrists and assistant optometrists.

Ethical Declarations

Ethical approval: IRB: CRREC-108-137

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Disclosure

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