

Quality of life in adult intermittent exotropia and the risk factors

Bo-Wen Zhao¹, Jing Fu¹, Jing-Hui Wang¹, Hai-Xia Bai², Pei-Pei Liu¹, Ya-Nan Guo¹, Rong-Han Zhang¹, Han Su¹

¹Beijing Tongren Eye Center, Beijing Tongren Hospital, Capital Medical University; Beijing Ophthalmology & Visual Sciences Key Laboratory, Beijing 100730, China

²Eye Center, Second Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou 310009, Zhejiang Province, China

Correspondence to: Jing Fu. Beijing Tongren Eye Center, Beijing Tongren Hospital, Capital Medical University; Beijing Ophthalmology & Visual Sciences Key Laboratory, Dongjiaominxiang, No.1 Sreet, Beijing 100730, China. fu_jing@126.com

Received: 2019-10-13 Accepted: 2020-07-01

Abstract

• **AIM:** To study the quality of life of adult patients with intermittent exotropia (IXT) in China and analyze the factors affecting the quality of life in IXT patients.

• **METHODS:** Totally 109 cases of normal eye (control group), 77 cases of IXT (IXT group) and 115 cases of strabismus control group (except IXT) were collected. The quality of life of the patients was assessed by Chinese version of adult strabismus patient's quality of life scale (CAS-20). The differences of general characteristics, visual function and quality of life were analyzed, and the effects of individual factors and visual function on quality of life of patients with IXT were analyzed.

• **RESULTS:** The IXT group had a high proportion of patients with family history, low proportion of patients with amblyopia compared with strabismus control group. The proportion with normal near and far stereopsis of IXT group were lower than that of normal control group. The best corrected visual acuity of IXT group was higher than that of strabismus control group, but lower than the control group. In addition, the median strabismus degree in IXT group was higher than that in other strabismus control group. The median psychosocial scores and median visual function scores of the IXT group was lower than that of the normal control group, but not different from strabismus control group. Occupation status, course of disease, far stereopsis and near stereopsis significantly affected the quality of life in IXT patients.

• **CONCLUSION:** Adult IXT patients in China have a certain proportion of family history and lower quality of life, The main factors affecting the quality of life of IXT patients is stereopsis, course of disease and occupation status.

• **KEYWORDS:** intermittent exotropia; quality of life; scale; binocular function

DOI:10.18240/ijo.2021.03.18

Citation: Zhao BW, Fu J, Wang JH, Bai HX, Liu PP, Guo YN, Zhang RH, Su H. Quality of life in adult intermittent exotropia and the risk factors. *Int J Ophthalmol* 2021;14(3):442-447

INTRODUCTION

Intermittent exotropia (IXT) is a kind of strabismus in which the eye position either tends to outside or to the positive position. IXT is a common condition that affects patients of all ages^[1]. The prevalence of IXT is high, about 1%-5% in the population, and it ranks the first among exotropia of all ages in China^[2]. It not only affects the appearance of patients, but also leads to the impairment of binocular vision function and eye movement abnormality^[3], which causes different degrees of psychosocial problems and affects the quality of life of patients. The influence of strabismus on quality of life has generally been informal in clinical assessment and is mostly focused in children^[4-5]. Adults with strabismus have also been reported to suffer from low self-esteem and have problems with inter-personal relationships, especially social anxiety. There were also reports pointing that strabismus affected the quality of life of Chinese Han teenagers^[6]. The strabismus surgery can effectively improve the life quality of children with IXT and their parents after surgical treatment^[7].

Although IXT is always found in children, IXT may finally progress to constant exotropia and has a serious influence on quality of life in adults^[8]. The Chinese version of the adult strabismus quality of life assessment scale (CAS-20) was translated and improved on the basis of the CAS-20 version of AS-20, which has good reliability and validity^[9-11]. This study used the CAS-20 to evaluate the impact of IXT on the quality of life of adult patients in comparison with normal subjects and other strabismus patients (except IXT), to explore the factors

affecting the quality of life of patients with IXT, so as to provide a basis for the clinical diagnosis and treatment of IXT.

SUBJECTS AND METHODS

Ethical Approval In accordance with the Helsinki Declaration, all participants were informed before the study and signed the informed consent. The study protocol was approved by the Ethics Committee of Beijing Tongren Hospital.

Populations From July 2018 to June 2019, 77 adult patients with IXT from Beijing Tongren Hospital were enrolled as the disease group; 115 patients with other type of strabismus (except IXT) were enrolled as strabismus control group; additional 109 subjects with normal eyes were enrolled as the normal control group.

Inclusion criteria include: definite diagnosis by specialist examination as strabismus or IXT as previously described^[12]; age above 18 years old; comprehensible and complete questionnaire survey. Exclusion criteria include: combined with obvious facial scars and defects; combined with other eye appearance abnormalities (such as blepharoptosis, thyroid-related ophthalmopathy, orbital deformity, etc.) and other eye or body diseases; reading and cognitive impairment; unable to understand and complete the questionnaire after explanation.

CAS-20 Questionnaire CAS-20 questionnaire includes two dimensions of social psychology and visual function. Each dimension contains 10 items. Each item has five levels of response. The grades are divided into never, rarely, sometimes, often and always, which correspond to 100, 75, 50, 25 and 0 points, respectively. The average score is obtained in statistics, and the scores of social psychology dimension and vision function dimension are obtained. The higher the score of functional dimensions, the better the quality of life.

All questionnaires were conducted by the same researcher. The subjects completed the quality of life questionnaire. If the subjects did not understand individual items, they could be explained by the researcher. After the completion of the questionnaire, the researcher checked its completeness.

General Information All participants completed individual information collection, including age, gender, family history of strabismus, occupation, marital status, diplopia and strabismus course. Compound tropicamide is used for mydriatic optometry in patients between 18 and 40 years old and no dilation optometry is used in patients above 40 years old to check best corrected visual acuity (BCVA). Anterior segment and fundus were routinely checked to exclude other eye diseases besides strabismus and amblyopia. Stereoscopic stereogram was used to examine near stereopsis (normal: less than or equal to 60 arc seconds). Far stereopsis was detected by synoptophore. Horizontal and vertical strabismus degree was measured with prism + alternating occlusion or prism + corneal reflection.

Statistical Analysis All data were input and checked by Excel table and analyzed by SPSS 16.0 software. Chi-square test and Kruskal-Wallis test were used to analyze the differences of general characteristics, visual function and scores between normal control group, IXT group and other types of strabismus control group; independent sample *t*-test was used to analyze the difference of course of disease between two strabismus groups; Wilcoxon test was used to analyze strabismus degree between two strabismus groups and to analyze the influence of individual factors on the quality of life of patients with IXT (Kruskal-Wallis test was used to analyze the influence of age on the quality of life of patients with strabismus). $P < 0.05$ was taken as statistical significance, when pairwise comparison variables in multiple samples. The test level was corrected to 0.017, that is, when $P < 0.017$, the difference between the two groups was considered to be significant.

RESULTS

General Information As indicated in Table 1, no significant difference was observed among groups regarding the age and gender.

Outcomes of Social Data As shown in Table 1, there was no significant difference in the composition of marital status ($\chi^2=3.725$, $P=0.155$). Among strabismus patients, the proportion of patients with family history in IXT group was higher than that of strabismus control group ($\chi^2=5.901$, $P=0.015$). There were significant differences in occupational composition among the three groups ($\chi^2=8.064$, $P=0.018$). Further comparisons showed that the employed in strabismus control group was significantly lower than that in the normal control group ($\chi^2=7.706$, $P=0.005$). There was no significant difference between IXT group and normal control group, IXT group and strabismus control group ($\chi^2=0.865$, $P=0.352$; $\chi^2=2.488$, $P=0.115$).

Visual Function Data The proportion of patients with amblyopia in IXT group was significantly lower than that in strabismus control group ($\chi^2=22.973$, $P < 0.001$); the proportion of patients with diplopia in IXT group was not significantly different from that in strabismus control group ($\chi^2=1.156$, $P=0.282$). The proportion of patients with vertical strabismus in IXT group was not significantly different from that in strabismus control group ($\chi^2=0.354$, $P=0.551$; Table 1). The proportion of people with normal near stereopsis was different among the three groups ($\chi^2=180.275$, $P < 0.001$). The results of pairwise comparison showed that the proportion of normal near stereopsis in the IXT group and strabismus control group was lower than that in the normal control group ($\chi^2=37.153$, $P < 0.001$; $\chi^2=165.982$, $P < 0.001$; Table 1). the proportion of normal near stereopsis in the IXT group was higher than that in the strabismus control group ($P < 0.001$).

Table 1 General and clinical information of the participants in three groups

Index	Normal	Intermittent exotropia	Strabismus	Statistic	<i>P</i>
Age (y)	31.70±10.84	28.08±6.67	31.48±11.29	Kru-Wall	3.585 0.167
Gender				CHISQ	0.668 0.716
Male	55 (50.46%)	37 (48.05%)	62 (53.91%)		
Female	54 (49.54%)	40 (51.95%)	53 (46.09%)		
Family history				CHISQ	5.901 0.015
No		63 (81.58%)	107 (93.04%)		
Yes		14 (18.42%)	8 (6.96%)		
Occupation				CHISQ	8.064 0.018
Unemployed	20 (18.35%) ^c	20 (25.97%)	40 (34.78%) ^a		
Employed	89 (81.65%)	57 (74.03%)	75 (65.22%)		
Marital status				CHISQ	3.725 0.155
No	50 (45.87%)	46 (59.21%)	64 (55.65%)		
Yes	59 (54.13%)	31 (40.79%)	51 (44.35%)		
Amblyopia				CHISQ	22.973 <0.001
No		75 (97.40%)	80 (69.57%)		
Yes		2 (2.60%)	35 (30.43%)		
Diplopia				CHISQ	1.156 0.282
No		54 (70.13%)	72 (62.61%)		
Yes		23 (29.87%)	43 (37.39%)		
Near stereopsis				CHISQ	180.275 <0.001
No	0 ^{b,c}	23 (29.87%) ^{a,c}	100 (86.96%) ^{a,b}		
Yes	109 (100.00%)	54 (70.13%)	15 (13.04%)		
Far stereopsis				CHISQ	195.970 <0.001
No	3 (2.75%) ^{b,c}	63 (81.82%) ^a	102 (88.70%) ^a		
Yes	106 (97.25%)	14 (18.18%)	13 (11.30%)		
Vertical strabismus				CHISQ	0.354 0.551
No		53 (68.83%)	84 (72.81%)		
Yes		24 (31.17%)	31 (27.19%)		
Corrected visual acuity, right	1.05±0.15 ^{b,c}	0.99±0.11 ^{a,c}	0.79±0.40 ^{a,b}	Kru-Wall	39.315 <0.001
Corrected visual acuity, left	1.05±0.15 ^{b,c}	1.00±0.13 ^{a,c}	0.88±0.32 ^{a,b}	Kru-Wall	24.045 <0.001
Degree of prism		-50.00 (-80.00, -30.00)	-30.00 (-80.00, 30.00)	Wilcoxon	8.401 0.003
Course of disease (mo)		162.95±118.21	168.55±130.91	<i>t</i> -test	0.014 0.907
Total score of social psychology	950.00 (900.00, 975.00) ^{b,c}	475.00 (375.00, 600.00)	500.00 (325.00, 650.00)	Kru-Wall	187.886 <0.001
Total score of visual function	900.00 (875.00, 975.00) ^{b,c}	525.00 (400.00, 650.00)	575.00 (450.00, 725.00)	Kru-Wall	178.071 <0.001

Variables involving pairwise comparisons were corrected to 0.017 for multiple comparisons, *i.e.* when $P < 0.017$, there was a statistical difference between the two groups. ^aSignificant difference from the normal group; ^bSignificant difference from the intermittent exotropia group; ^cSignificant difference from strabismus control group. *P* values indicated the difference between intermittent exotropia and other types of strabismus control groups.

The proportion of people with normal far stereopsis was different among the three groups ($P < 0.001$). The results of pairwise comparison showed that the proportion of patients with normal far stereopsis in IXT group and strabismus control group was lower than that in normal control group ($P < 0.001$). There was no significant difference between IXT and other types of strabismus ($P = 0.186$; Table 1).

There were significant differences in the overall comparison of BCVA among the three groups ($H_{right} = 39.315$, $P < 0.001$; $H_{left} = 24.045$, $P < 0.001$). BCVA of the IXT group and strabismus

control group was lower than that of the normal control group ($P < 0.01$), and the BCVA of the IXT group was higher than that of strabismus control group ($P < 0.001$). The median level of strabismus degree in IXT group was higher than that in strabismus control group ($Z_{right} = 8.401$, $P = 0.003$; $Z_{left} = 5.342$, $P = 0.02$; Table 1).

Quality of Life in Patients with Intermittent Exotropia

The scores of social psychology in the three groups were significantly different ($Z = 187.886$, $P < 0.001$; Table 1). The median psychosocial score of IXT group was 475.00

(375.00, 600.00), lower than that of normal control group [950.00 (900.00, 975.00)] ($Z=-11.098, P<0.001$); the median psychosocial score of strabismus control group was 500.00 (325.00, 650.00), also lower than that of normal control group ($Z=12.306, P<0.001$). However, there was no significant difference between IXT and strabismus control groups ($Z=-0.111, P=0.911$).

The scores of visual functions in the three groups were significantly different ($Z=178.071, P<0.001$). The median visual function score of IXT group was 525.00 (400.00, 650.00), lower than that of normal control group [900.00 (875.00, 975.00)] ($Z=-10.909, P<0.001$); the median visual function score of strabismus control group was 575.00 (450.00, 725.00), also lower than that of normal control group ($Z=11.785, P<0.001$). However, there was no significant difference between IXT and strabismus control groups.

Influencing Factors of Quality of Life in Patients with Intermittent Exotropia As shown in Table 2, there was no significant difference in psychosocial scores between the practitioners and the unemployed (including students/unemployment/retirement; $Z=1.168, P=0.243$), but the visual function scores of the practitioners were lower than those of the unemployed ($Z=2.559, P=0.009$). The visual function scores were higher in those with normal near stereopsis ($Z=-2.072, P=0.038$) and with normal far stereopsis ($Z=3.027, P=0.003$). The psychosocial scores of strabismus patients with a course of more than five years were lower than those with a course of less than five years ($Z=7.037, P=0.008$). Sex, age, marital status, vertical strabismus, diplopia, amblyopia, and family history had no significant effect on the psychosocial scores and visual function scores of patients with IXT.

DISCUSSION

Our present study demonstrated that IXT patients had a higher family history, lower rates of amblyopia compared with other types of strabismus. BCVA of IXT group was better than that of strabismus control group.

Satterfield^[13] found that the main psychosocial problems of strabismus patients included impaired self-esteem and self-confidence, sensitive interpersonal relationships, fewer job opportunities, and inactive exercise. This study found that there was no significant difference in occupational composition between the IXT group and the normal control group, while the proportion of employees in other strabismus control group was lower than that in the normal control group. There are two possible reasons. First, other strabismus affects the appearance of patients, thus affecting employment^[14]. Second, since patients do not have normal binocular vision function (stereopsis), many jobs are limited, and the employment rate is low. IXT patients might have normal eye position, and near

Table 2 Influencing factors of quality of life in patients with intermittent exotropia

Parameters	Social psychology (median/quantile)	Visual function (median/quantile)
Gender		
Male	475.00 (395.00-625.00)	500.00 (375.00-650.00)
Female	450.00 (350.00-572.50)	525.00 (425.00-637.50)
Statistic	$Z=0.546, P=0.585$	$Z=-0.627, P=0.530$
Occupation status		
Unemployed	550.00 (425.00-625.00)	625.00 (575.00-750.00)
Employed	450.00 (325.00-600.00)	500.00 (375.00-600.00)
Statistic	$Z=1.168, P=0.243$	$Z=2.559, P=0.009$
Marital status		
No	550.00 (400.00-625.00)	525.00 (425.00-675.00)
Yes	450.00 (250.00-575.00)	500.00 (375.00-600.00)
Statistic	$Z=2.436, P=0.118$	$Z=1.379, P=0.240$
Age		
<30	550.00 (375.00-650.00)	575.00 (400.00-675.00)
30-40	450.00 (300.00-525.00)	450.00 (375.00-550.00)
>40	400.00 (395.00-525.00)	525.00 (450.00-600.00)
Statistic	$H=2.592, P=0.273$	$H=4.428, P=0.109$
Far stereopsis		
No	450.00 (350.00-575.00)	500.00 (375.00-600.00)
Yes	575.00 (425.00-750.00)	675.00 (575.00-800.00)
Statistic	$Z=1.732, P=0.083$	$Z=3.027, P=0.003$
Vertical strabismus		
No	500.00 (395.00-600.00)	525.00 (425.00-650.00)
Yes	425.00 (275.00-612.50)	525.00 (362.50-625.00)
Statistic	$Z=-1.288, P=0.197$	$Z=-0.539, P=0.589$
Near stereopsis		
No	475.00 (325.00-650.00)	425.00 (325.00-600.00)
Yes	475.00 (375.00-600.00)	537.50 (450.00-675.00)
Statistic	$Z=-0.417, P=0.676$	$Z=-2.072, P=0.038$
Diplopia		
No	462.50 (350.00-575.00)	512.50 (400.00-625.00)
Yes	550.00 (375.00-725.00)	525.00 (375.00-675.00)
Statistic	$Z=1.381, P=0.167$	$Z=0.055, P=0.955$
Amblyopia		
No	475.00 (350.00-600.00)	525.00 (375.00-650.00)
Yes	600.00 (475.00-725.00)	625.00 (450.00-800.00)
Statistic	$Z=0.929, P=0.353$	$Z=0.609, P=0.542$
Course of disease		
<5y	562.50 (425.00-725.00)	550.00 (375.00-750.00)
>5y	450.00 (300.00-575.00)	525.00 (400.00-625.00)
Statistic	$Z=7.037, P=0.008$	$Z=1.274, P=0.259$
Family history		
No	475.00 (375.00-625.00)	525.00 (400.00-650.00)
Yes	450.00 (175.00-600.00)	537.50 (325.00-725.00)
Statistic	$Z=-0.603, P=0.546$	$Z=-0.147, P=0.883$

P values indicated the differences of social psychology and vision function between inner groups of gender, occupation, marital status, age, far stereopsis, vertical strabismus, near stereopsis, diplopia, course of disease, and family history.

stereopsis function is relatively good. Thus, the employment situation is better than other strabismus patients.

The BCVA of the two strabismus groups were lower than that of the normal control group. The BCVA of strabismus control group was lower than that of the IXT group, and the proportion of amblyopia was higher than that of the IXT group. On the one hand, strabismic amblyopia was not easy to be caused in the patients with IXT. On the other hand, other type strabismus patients including disused strabismus and strabismic amblyopia own poor vision, resulting in the lower BCVA^[15].

This study found that the proportion of people with near and far stereopsis in IXT group and strabismus control group was lower than that in normal control group. The proportion of people with near and far stereopsis in strabismus control group was lower than that in IXT group. IXT is characterized by damage of far stereopsis, similar to other types of strabismus^[16-17]. The proportion of patients with family history in IXT group is higher than that in other types of strabismus control group. At present, the reasons have not been reported. Therefore, we should pay more attention to related genetic research in future research^[18-19].

Hatt *et al*^[20-21] showed that the social psychological health of strabismus patients was lower than that of normal people, and the quality of life was reduced accordingly, especially in adult strabismus patients who had participated in social activities. In this study, the quality of life of adult strabismus patients was assessed by CAS-20 scale. It was found that the psychosocial score and visual function score of IXT group and strabismus control group were lower than those of the normal control group, which was consistent with the results of Hatt *et al*^[20-21].

Other studies have found that strabismus has a certain relationship with gender, among which female patients are more easily affected^[20,22], especially in the workplace^[23-24]. With the increase of age, the influence of strabismus on patients' social psychology is more obvious^[25]. In addition, race, region, economic status and other factors also have a significant impact on the quality of life of strabismus patients^[26]. However, the effects of deviation types such as esotropia and exotropia on the quality of life of patients are still unclear^[27-28]. Our results showed that gender, age and marital status had no significant effect on the quality of life of patients with IXT.

Strabismus not only causing the damage of patients' visual function, but also influencing the appearance. At present, all clinical examinations (vision, binocular vision, eye position) can only reflect the damage of patients' visual function, but not the psychological problems. The results of this study show that there is no significant difference in psychosocial scores between the employed and the unemployed in patients with IXT, but the visual function score of the employed is lower than that of the unemployed, presumably because

the employed have higher requirements for visual function and more stringent evaluation of self-stereopsis. The visual function score of IXT patients with normal near/far stereopsis is higher than that of patients without normal near/far stereopsis. These indicators show that patients' perception of their visual function is relatively consistent with the results of objective examination.

The purpose of this study is to study the quality of life of Chinese patients with IXT. In this study, we analyzed the quality of life of patients with IXT compared with that of normal people and other type strabismus people and provided potential implications whether surgery can improve the quality of life. In addition, the doctors and society should pay more attention to the quality of life of patients with IXT.

There are still some limitations in this study. The age of the subjects was concentrated between 20 to 40. Therefore, the research results mainly reflected the quality of life of young people. The data of middle-aged and old people were required to be collected in the future to evaluate the quality of life of all adult patients with IXT.

In conclusion, the quality of life of adult patients with IXT in China was significantly decreased. Stereopsis, course of disease and occupation status were the main factors affecting the quality of life of IXT patients, which could provide some basis for clinical diagnosis and treatment of IXT.

ACKNOWLEDGEMENTS

Foundations: Supported by the Beijing Talent Youth Training Program and Beijing Municipal Administration of Hospitals Incubating Program (No.PX2017045); Beijing Municipal Science & Technology Commission (No.Z171100001017066); Beijing Municipal Science & Technology Commission (No. Z201100005520044).

Conflicts of Interest: Zhao BW, None; Fu J, None; Wang JH, None; Bai HX, None; Liu PP, None; Guo YN, None; Zhang RH, None; Su H, None.

REFERENCES

- Holmes JM, Hatt SR, Leske DA. Is intermittent exotropia a curable condition? *Eye (Lond)* 2015;29(2):171-176.
- Zhu H, Shen L, Yuan CQ, Xu S, Leng ZH, Fu ZJ, Xiao YH, Liu H. The development of the Chinese intermittent exotropia questionnaire. *Optom Vis Sci* 2017;94(6):707-713.
- Chougule P, Kekunnaya R. Surgical management of intermittent exotropia: do we have an answer for all? *BMJ Open Ophthalmol* 2019;4(1):e000243.
- Shahraz S. Quality of life and strabismus surgery in children. *J Ophthalmic Vis Res* 2016;11(2):129-130.
- Ziaei H, Katibeh M, Mohammadi S, Mirzaei M, Moein HR, Kheiri B, Taghaddos S, Rajavi Z. The impact of congenital strabismus surgery on quality of life in children. *J Ophthalmic Vis Res* 2016; 11(2):188-192.

- 6 Tu CS, Ye L, Jiang LF, Wang YW, Li YZ. Impact of strabismus on the quality of life of Chinese Han teenagers. *Patient Prefer Adherence* 2016;10:1021-1024.
- 7 Xiao H, Zhu H, Liu H. Evaluation of life quality of children with intermittent exotropia one year after the effective surgical treatment. 2019;55(1):31-36.
- 8 Schlossman A, Muchnick RS, Stern KS. The surgical management of intermittent exotropia in adults. *Ophthalmology* 1983;90(10):1166-1171.
- 9 Zhu H, Xu S, Leng ZH, Fu ZJ, Xiao YH, Liu H. Utilization of quality-of-life assessment questionnaires for intermittent exotropia in China. *Zhonghua Yan Ke Za Zhi* 2016;52(8):596-603.
- 10 Wang ZH, Bian W, Ren H, Frey R, Tang LF, Wang XY. Development and application of the Chinese version of the adult strabismus quality of life questionnaire (AS-20): a cross-sectional study. *Health Qual Life Outcomes* 2013;11:180.
- 11 Wang Z, Ren H, Frey R, Liu Y, Raphael D, Bian W, Wang X. Comparison of the Adult Strabismus Quality of Life Questionnaire (AS-20) with the Amblyopia and Strabismus Questionnaire (ASQE) among adults with strabismus who seek medical care in China. *BMC Ophthalmol* 2014;14:139.
- 12 Pediatric Eye Disease Investigator Group, Mohny BG, Cotter SA, Chandler DL, Holmes JM, Chen AM, Melia M, Donahue SP, Wallace DK, Kraker RT, Christian ML, Suh DW. A randomized trial comparing part-time patching with observation for intermittent exotropia in children 12 to 35mo of age. *Ophthalmology* 2015;122(8):1718-1725.
- 13 Satterfield D. Psychosocial aspects of strabismus study. *Arch Ophthalmol* 1993;111(8):1100.
- 14 Durnian JM, Noonan CP, Marsh IB. The psychosocial effects of adult strabismus: a review. *Br J Ophthalmol* 2011;95(4):450-453.
- 15 Bui Quoc E, Milleret C. Origins of strabismus and loss of binocular vision. *Front Integr Neurosci* 2014;8:71.
- 16 Kekunnaya R, Chandrasekharan A, Sachdeva V. Management of strabismus in myopes. *Middle East Afr J Ophthalmol* 2015;22(3):298-306.
- 17 Zhu H, Yu JJ, Yu RB, Ding H, Bai J, Chen J, Liu H. Association between childhood strabismus and refractive error in Chinese preschool children. *PLoS One* 2015;10(3):e0120720.
- 18 Plotnikov D, Shah RL, Rodrigues JN, Cumberland PM, Rahi JS, Hysi PG, Atan D, Williams C, Guggenheim JA, UK Biobank Eye and Vision Consortium. A commonly occurring genetic variant within the NPLOC4-TSPAN10-PDE6G gene cluster is associated with the risk of strabismus. *Hum Genet* 2019;138(7):723-737.
- 19 Sharma P, Gaur N, Phuljhele S, Saxena R. What's new for us in strabismus? *Indian J Ophthalmol* 2017;65(3):184-190.
- 20 Hatt SR, Leske DA, Kirgis PA, Bradley EA, Holmes JM. The effects of strabismus on quality of life in adults. *Am J Ophthalmol* 2007;144(5):643-647.
- 21 Hatt SR, Leske DA, Liebermann L, Philbrick KL, Holmes JM. Depressive symptoms associated with poor health-related quality of life in adults with strabismus. *Ophthalmology* 2014;121(10):2070-2071.
- 22 McKenzie JA, Capo JA, Nusz KJ, Diehl NN, Mohny BG. Prevalence and sex differences of psychiatric disorders in young adults who had intermittent exotropia as children. *Arch Ophthalmol* 2009;127(6):743-747.
- 23 Mojon-Azzi SM, Mojon DS. Strabismus and employment: the opinion of headhunters. *Acta Ophthalmol* 2009;87(7):784-788.
- 24 Coats DK, Paysse EA, Towler AJ, Dipboye RL. Impact of large angle horizontal strabismus on ability to obtain employment. *Ophthalmology* 2000;107(2):402-405.
- 25 Paysse EA, Steele EA, McCreery KM, Wilhelmus KR, Coats DK. Age of the emergence of negative attitudes toward strabismus. *J AAPOS* 2001;5(6):361-366.
- 26 McBain HB, MacKenzie KA, Au C, Hancox J, Ezra DG, Adams GG, Newman SP. Factors associated with quality of life and mood in adults with strabismus. *Br J Ophthalmol* 2014;98(4):550-555.
- 27 Goff MJ, Suhr AW, Ward JA, Croley JK, O'Hara MA. Effect of adult strabismus on ratings of official US army photographs. *J AAPOS* 2006;10(5):400-403.
- 28 Olitsky SE, Sudesh S, Graziano A, Hamblen J, Brooks SE, Shaha SH. The negative psychosocial impact of strabismus in adults. *J AAPOS* 1999;3(4):209-211.