Research Article

The Study of Refractive Error of Adults over 18 Years Visiting Some Optometry Centers in Ulaanbaatar City

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Abstract

Background:

The second cause of blindness in the world is a refractive error. In Mongolia, 36% of blindness over 50 years is caused by refractive error. There are a few numbers of children refractive errors studies but the research works among adults over 18 years old are lack.

Goal:

To study and analyze the outcomes of refractive error over 18 years old adults who visited some optometry centers in Ulaanbaatar city.

Materials and methodology:

From January 2019 to May 2019 we have collected the refractive data of 703 patients (1405 eyes) aged over 18 years from 5 optometry centers under the checking of visual acuity and determination of subjective and objection refraction. SPSS 20 program was used to perform the statistical analysis of the study.

Result.

Participants of this study were from Ulaanbaatar city and all provinces of Mongolia. This study shows that myopia was the most common refractive error over 18 years and the prevalence of myopia was decreasing with the aging of participants. Also, we have found the highest pick of myopia (44%) was among young people between 18-29 years. The prevalence of emmetropia was increasing between 40 and 49 years old patients. Although myopic patients 331 (47%) answered that their family members worn vision glasses (spectacles) there was no association between family members' vision glasses and refractive error of the participants (p>0.08). We have checked near vision of 211 (woman 28%/59, men 72%/152) participants aged over 40 and clinical analysis showed a high prevalence of presbyopia in the age group 50-59.

Conclusion

Among 703 participants with refractive error, the emmetropia was 21%, myopia 57.2%, astigmatism 17.2%, and hyperopia 4.6%. The age and refractive error are statistically significant (p=0.001). Screen usage has a low correlation with refraction error (r=1.67). The moderate hyperopia was the most common (37%) refractive error of presbyopia in age between 50-69 years.

Keywords

Emmetropia, Myopia, Hyperopia, Presbyopia.

Introduction

According to the WHO the refractive error is one of the most common eye disorders. In the World 2.2 billion people are blind, and 1 billion have refractive errors, of which 123.7 million can be repaired with glasses. 65% of the blind peoples are over 50 years old, which is 20% of the total population. Refractive error is 43% of total vision loss (myopia, hyperopia, astigmatism), cataracts 33% and glaucoma 2%. Refractive error is one of the leading causes of blindness and one of the most preventable diseases affecting all segments of society. Many studies of refractive errors show steadily increasing rates occur in both developing and developed countries.

In the report of rapid assessment of avoidable blindness 2015, refractive error is 22.9% of severe visual impairment and 45.5% of mild visual impairment among people over 50 years.

In the South Korean study myopia was 51.9%, hyperopia 13.4%, and astigmatism 31.2%, while in Singapore myopia occurred in 79.3%.

Untreated refractive errors have negative consequences to education, employment, society, the economy, as well as children and adults. Unpreventable refractive errors can be treated with spectacles, contact lenses and surgery. Refractive studies in Mongolia have shown that children's refraction and diseases are more studied. That is why our work is based on the study of adults' refractive errors in vision centers.

The purpose of our study:

To summarize and analyze the refractive errors of the aged clients who have been treated at Ulaanbaatar vision centers. The objective of the research was:

1. To identify the type of refraction in people over 18.
2. To study the risk factors relationship between refractive error.
3. To study the characteristics of presbyopia in clients older than 40.

Method and methodology

The survey was conducted among the population over the age of 18 served by the Vision Centers using a one-time survey model and according to the methodology approved by the meeting of the Ophthalmology Department, Academy of Medical Sciences Mongolia, December 25, 2018, and with the meeting of the Research Ethics Committee of Academy of Medical Sciences of Mongolia, January 18, 2019. The 754 people over the age of 18 visited the vision centers during the study. The patients in vision centers have been examined with an auto refractometer, the best-corrected visual was determined with a phoropter and slit-lamp examination was used if required. Total 703 clients were included and 51 clients who did not meet the selection criteria were excluded. Glasses were prescribed to required patients.

	Number	Percent
Gender		
Male	238	33
Female	465	67
Age group		
18-19	84	8.3
20-29	245	34
30-39	163	19
40-49	75	11
50-59	78	11
60-69	40	5
70 and high	18	2
Address		
Ulaanbaatar city	582	82.7
Province	114	16.2
Foreign	7	1
All	703	100

Table 1. Patients introduction

The youngest patient is 18, the oldest 85, and the average age of the participants is 34.8 ± 14.8. 67% of the clients are women. 70% of the participants were analyzed at the Manal Vision Center. The largest number of participants (n = 582, 82.8%) is Ulaanbaatar residents.

	NCVA (Decimal)				BCVA (Decimal)		
Age	**N**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**
18-19	84	0.2±0.23	0.9	0.01	0.96±0.07	1	0.5
20-29	245	0.2±0.22	1	0.02	0.94±0.12	1	0.1
30-39	163	0.3±0.23	1	0.02	0.93±0.13	1	0.1
40-49	75	0.5±0.36	1	0.02	0.68±0.38	1	0.1
50-59	78	0.4±0.34	1	0.02	0.7±0.37	1	0.1
60-69	40	0.4±0.3	1	0.04	0.74±0.3	1	0.1
70 >	18	0.45±0.27	1	0	0.49±0.3	1	0.1
All	703	0.3±0.28	1	0	0.86±0.25	1	0.1

Table 2. Visual acuity of the patients

Patients' visual acuity shows a statistical difference between age and visual acuity (p = 0.0001). Age has a positive correlation to visual acuity. (r = 0.274). The average NCVA (not corrected visual acuity) was 0.3 ± 0.28, while the average BCVA (best-corrected visual acuity) was 0.86 ± 0.25. In the group over 70, the mean and standard deviation of the BCVA was the lowest, 0.49 ± 0.3. The average vision of all patients VA has been improved 50% after visiting optic centers (**Table 2**).

Refractive errors	**Male n=238**		**Female n=465**		**All n=703**	
	И	**%**	**И**	**%**	**И**	**%**
Emmetropy	49	20.6	98	21.1	147	21
Myopia	139	58.8	263	56.6	402	57.2
Mild	103	43.3	187	40.2	290	41.3
Medium	35	14.7	75	16.6	110	16
High	1	0.4	1	0.2	2	0.5
Hyperopia	7	2.9	24	5.1	31	4.6
Mild	3	1.3	16	3.4	19	2.7
Medium	4	1.7	8	1.7	12	1.7
High	1	0.4	1	0.2	2	0.2
Astigmatism	42	17.6	79	17.6	121	17.2
Myopic	30	12.6	58	12.5	88	13
Normal	11	4.6	15	3.2	26	3.6
Mixed	1	0.4	6	1.3	7	0.1
All	238		465		703	100

p>0.05

Table 3. Refractive error classification

The majority of visitors to the vision center 66% were women, which indicates that women care more about their health than men. Hyperopia was 2.6 times more common in women than in men (**Table 3**). Mixed astigmatism occurred in 12.5-12.6% of cases, while normal astigmatism occurred in 6% of men and 3.6% of women, making astigmatism more common in men. There were no statistically significant differences in the type and degree of refraction depending on sex (p=0.75) (**Table 3**).

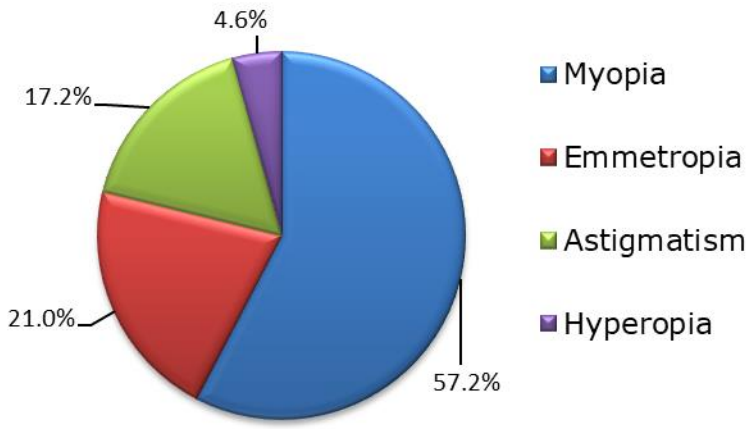

Figure 1. Refractive error

Age group								
	18-19	20-29	30-39	40-49	50-59	60-69	70>	P
Emmetropy	9.5	27	24	44	41	35	50	0.313
Myopia								
Mild	52.4	49.4	49	18.7	23.1	27.5	16.7	0.473
Moderate	17.9	17.6	17.2	13.3	14.1	10	5.6	0.599
High	0	0.4	0.6	0	0	0	0	0.223
Hyperopia								
Mild	2.4	1.6	1.8	5.3	3.8	5	5.6	0.264
Moderate	0	1.2	0	2.7	2.6	5	0	0.046
High	0	0.4	0	0	1.3	0	0	0.339
Astigmatism								
Myopic	16.7	14.7	11	13.3	9	5	5	NS*
Normal	1.2	3.7	4.3	1.3	5.1	5	11.1	NS*
Mixed	0	0	2	1	0	3	1	0.135

*NS-(no significance), P=0.01 r=0.425

Table 4. Comparison between refractive error and age

Myopia occurs in 52.4% of young people aged 18-19 years, but the prevalence decreases to 16.7% with age. High forms of myopia are rare in all age groups (0.6%). Emmetropia was less than 9.5% between the ages of 18 and 20, but the incidence increased to 50% with age. Astigmatism occurred in approximately 17.9–17.1% of all age groups, and the incidence of hyperopia decreased at a young age and increased with age (1.6–2.4%). Hyperopia was most common in people aged 40-59 years (5-5.3%). There was a statistically significant difference between refractive errors and age groups. (P=0.001) (**Table 4**) (**Figure 2**)

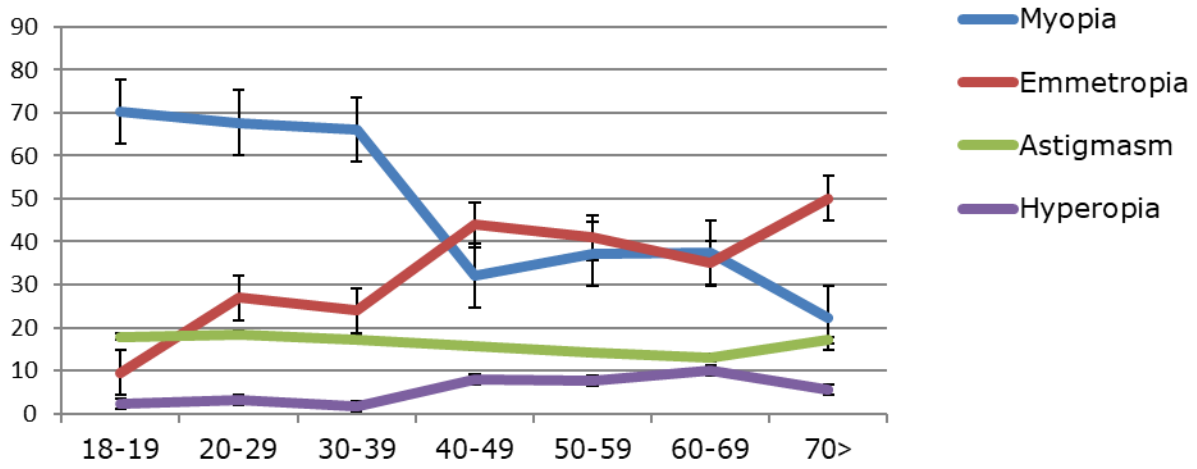

Figure2. Refractive error and age group

Age group	**N**	**Average**	**SD**	**P value**
18-19	84	-1.26	0.91	
20-29	245	-1.14	1.01	
30-39	163	-0.98	0.84	
40-49	75	-0.6	0.99	
50-59	78	-0.56	1.15	
60-69	40	-0.2	0.69	0,0001
70 >	18	0.005	0.36	
All	703	-0.9	1	

Table 5. Patients sphere equivalent

With the increasing of age SE increases. There is a moderate correlation between age and SE (r = 0.337). The mean SE of the participants was (-)0.9 ± 1.0 (**Table 5**)

Refraction and risk factor association

Risk factors for refraction include race, age, sex, genetics, geography, education, occupation, screen use, short-distance work, and outdoor time. In this study, we examined whether age, sex, screen usage time, and family spectacle use associate with refractive errors.

99% of the 703 people answered they use screens, TV or cell phones to our question how many hours do you spend on-screen usage. When evaluating the daily screen usage time, n = 159 (22.6%) of the total customers answered that they use 1-3 hours, n = 26 (0.3%) answered they use an hour,

3.8% for 12 hours and more daily. Screen use is the highest among 20-29-year-olds (20.9-40.3%). The average screen use of participants was 7.6 ± 6.2 hours. Aging decreases screen usage. There was a statistically significant and strong correlation between screen usage and age. (r = 0.598, p = 0.03) (**Table 6**)

	Daily screen usage (Percent)								
Age group	0-1	1-2	3-4	5-6	7-8	9-10	10-12	12>	N, %
18-19	7.7	13.2	9.6	14.1	13.1	12.7	18.5	6.9	84/11.9
20-29	26.9	35.2	22.8	43.6	33.6	35.4	33.3	40.3	245/35
30-39	38.5	18.9	24.0	21.8	24.1	27.8	18.5	22.2	163/23
40-49	15.4	11.3	15.2	7.7	8.8	6.3	0	15.3	75/10.7
50-59	3.8	12.6	14.4	7.7	10.2	11.4	11.1	9.7	78/11.1
60-69	3.8	3.1	5.6	5.1	8.0	3.8	18.5	5.6	40/5.7
70 >	3.8	9.0	2.4	0	2.2	2.5	0	0	18/2.6
N	26	159	125	78	137	79	27	72	703
%	3.7	22.6	17.8	11.1	19.4	11.2	3.8	10.2	100

r=0.598 p=0.03

Table 6. Age and daily screen usage

624 (89%) of total patients answered the question who of family members wears visual glasses and only 17 (2.4%) answered “grandparents”. Most of the answers 241 (34%) were “there is no other member who uses it”. The family glass use was the highest in 331 (47%) participants with myopic refractive error, and hyperopia was lowest in 26 (3.7%). There were no statistically significant differences between the use of spectacles and refraction by the patient’s family member. (P=0.08)

Presbyopia

The study covers 211 people over the age of 40, with 59/28% of men and 152/72% of women. Moderate hyperopia is the most common form of accommodation impairment in the age group 50-59 (77/36%). Astigmatism refractive error occurred in at least 2/0.9%, and there was a statistically significant difference between the moderate form of hyperopia and the age group, and a positive weak correlation (p=0.046, r=0.391).

All forms of hyperopia are the most common in people over 50. Emmetropia is common in people over 40 years, and other refractive errors are less common in near-sightedness (0.5-1.4%). Age groups have a weakly positive relationship between presbyopia and statistically significant differences. (p=0.001) (r=0.453)

The majority of 211 patients over the age of 40, were women (152/72%). Moderate hyperopia was the most common in men aged 60-69 (17%) when it was 19% in women aged 50-59. There weren’t statistically significant differences between presbyopia and sex (P value=0.618).

Discussion

According to the World Health Organization, 188.5 million people have severe or mild vision loss, of which 80% are preventable **(**1**)**. The current study examined visual acuity and other eye disorders.

Myopia is the highest than other eye diseases worldwide. The prevalence of myopia in the United States increased from 25% to 44% between 1974 and 2004. For refractive error, they spent USD 139 billion and USD 16 billion on myopia alone. In some Asian countries, the prevalence of myopia was 80% or more. **(**2**)** In our study highest refractive error was myopia (57.2%).

In the United States, Europe, and Australia studies include 29,281 people aged over 40. ≤-1.0D myopia 46%-61.90% in European women and 36.76%-21.58% in men, and in African population 22.52%-2.81%

in women, and 18.38% -13.64% was in men. In Hispanic women was 25.13%-19.7%, for men 21.82-13.01 (Kempen JH 2004). The study found that people with a European appearance were more likely to have myopia **(**3**)**. In our study, the prevalence of myopia ranged from 27.5% to 16.7% in people over the age of 40, which is similar to the Spanish-speaking population.

In Tyler Hyanteck Rim's 2008-2012 (South Korea) refractive study myopia was 39.6%, high myopia 5%, hyperopia 13.4%, and astigmatism 31.2%. Myopia was the most prevalent between the ages of 19 and 29, under the age of 39 hyperopias was decreasing and increasing over the age of 40, and the incidence of astigmatism decreasing with age. There was a high correlation between myopia and education, but a low correlation between hyperopia and astigmatism. **(**4**)** In our study, myopia was the most common refractive error and was more common in the 18-29-year-olds group, with a similar prevalence of hyperopia and astigmatism.

In the Mongolian study (1995) of South Gobi and Khuwsgul provinces, 1,800 (1,617) people have participated over the age of 40. Spherical equivalents and axial refraction have been calculated. Myopia was 17.2%, emmetropia was 49.9%, hyperopia was 32.9%, and astigmatism was 40.9%. The myopic refractive error between the ages 40 and over was 16.7-27.5%, which is higher than the results of this study, while hyperopia was 4.7% and astigmatism was between 1%-9%.5 After the calculation of the mean spherical equivalent, SE (-) was 0.9±1.0, indicating that myopic refractive error predominates among clients. Studies in Asian countries have linked the prevalence of myopia in young people to urbanization, economic growth, education levels, and genetics.

NHANES (National Health and Nutrition Examination Survey) 1999-2004 study, astigmatism was 31.0% of adults, Malaysians of Singapore 27.8%, and Chinese of Singapore 44.2%. Previous studies have shown that astigmatism increases with age. **(**4**)**

From the above studies, we see that our results are similar to some of the adult refraction studies in East Asian countries. Although our country is an economically developing country, the results of our research are similar to the results of the study of refractive errors in developed countries, which can be assumed as a result of technological progress. Although there is no program to train professional optometrists in Mongolia, the results of the survey show the high demand for this profession.

Conclusion

1. 21% of 703 patients treated at some vision centers in Ulaanbaatar has emmetropia, 57.2% myopia, 17.2% astigmatism and 4.6% hyperopia.

2. Statistically significant and moderate correlation (P=0.01 r= 0.425) is between refractive errors and age of the patients. There is a weak positive relationship between refractive error and screen use (r=1.67). There is no statistically significant difference between refractive error and spectacle use in other family members (p=0.08 p>0.05).

3. High prevalence 39% of presbyopia was in the age group 50-59. There was a statistically significant relationship between presbyopia and the age group (p=0.001) (r=0.453).

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