

Investigation of the Refractive Errors in Terms of Education Level in Central Anatolian Population

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Abstract

Purpose: To investigate of the refractive situations of healthy Central Anatolian population by separated groups in terms of different education level, in various age, gender, residence, and working status.

Materials and Methods: The past general polyclinic records between January 2015 and April 2015 was investigated retrospectively. The over 10-year old subjects being 20/20 best corrected visual acuity (BCVA) using Snellen chart and trial frame with or without addition of plus or minus glasses, were included in the current study. The study included only right eyes of 159 healthy subjects without any ocular diseases can affect the visual acuity and refractive error. These subjects were contacted via telephone and education level, residence, and working status were asked. The subjects were separated in terms of education level and spherical, cylindrical refractive errors and axes of negative cylindrical error were compared.

Results: The mean age was 59.50 ± 7.92 years (42 - 73 years), 36.37 ± 19.53 years (10 - 77 years), and 37.41 ± 15.18 years (17 - 66 years) in low, medium, and high education level groups. The mean spherical error was $+1.18 \pm 1.24$ D (-0.50 - +5.50 D) in low education level, -0.34 ± 1.40 D (-4.50 - +2.50 D) in medium education level, and -1.44 ± 1.92 D (-7.00 - +2.00 D) in high education level ($p < 0.001$). When comparing of 3 groups with each other, there were similar statistically significant difference (all $p < 0.001$). The mean cylindrical error and the axis of the negative cylindrical error were similar in all groups ($p < 0.001$, $p < 0.001$).

Conclusion: Myopic shift is occurred with increase of education level and according to the best of our knowledge this is the first report revealed this finding in Central Anatolian population.

Keywords: Refractive Error; Myopi; Hyperopia; Astigmatism

Introduction

Eye glob consists of several dynamic mechanisms providing the focusing of light on the macula as sharp point. Inability to work in a harmony of these mechanisms causes refractive error and it can be affect from several conditions. Refractive errors roughly separated as myopia, hyperopia, and astigmatism according to image-retina position. Myopia usually starts around the age of 9 to 10 years and progresses throughout adolescence. Hyperopia more common in younger children and it resolves by around the age of 10 years. Astigmatism affects all age groups and generally does not change over time [1]. Refractive error is the most treatable cause of vision loss, and it can be correct with spectacles, contact lenses, orthokeratology, or various surgical procedures [2-6]. The detection and correction of refractive error especially in childhood age are important public health concern in developing countries. The uncorrected refractive error is a target of World Health Organization's Vision 2020 initiative [7].

In the current study, we aimed to investigate of the refractive situations of healthy Central Anatolian population by separated groups in terms of different education level, in various age, gender, residence, and working status.

Materials and Methods

The study followed the tenets of the Declaration of Helsinki. This study was conducted in the ophthalmology department of a single tertiary hospital in Ankara (capitol of Turkey). The past general polyclinic records between January 2015 and April 2015 was investigated retrospectively. The over 10-year old subjects being 20/20 best corrected visual acuity (BCVA) using Snellen chart and trial frame with or without addition of plus or minus glasses, were included in the current study. The study included only right eyes of 159 healthy subjects living in Ankara without any ocular diseases can affect the visual acuity and refractive error such as cataract, ocular surgery, keratitis, keratoconus, strabismus, uveitis, glaucoma, diabetic retinopathy, and more. The absence of diseases had been corrected with fundoscopy, corneal topography, perimetry, and optical coherence tomography, if necessary. We contacted with these subjects via telephone and after the verbally information and consent, education level, residence, and working status were asked. The subjects were separated in terms of education level. Low education level group consist of illiterate, literate, and primary school graduated subjects. Medium education level group consist of mid- and high-school graduated subjects. High education level group consist of subjects graduated from university and further. Spherical, cylindrical refractive errors and axes of negative cylindrical error of groups were compared.

Statistical analyses were applied using Statistical Package for the Social Sciences (SPSS) 22.0 software (IBM Corp, New York, USA). The mean age, gender, residence, and working status of the groups were given in table form. Differences between the three groups in respect of spherical and cylindrical refractive errors and axis of negative cylindrical error were evaluated using Kruskal-Wallis H test, where applicable. The Bonferroni test was used as a post hoc test after Kruskal-Wallis H test. The level of significance was set at < 0.05. The Mann-Whitney U test was used for post-hoc analysis of 2 independent samples and p value of ≤ 0.05 was considered statistically significant.

Results

There were 30, 85, and 44 subjects in low, medium, and high education level groups respectively. The mean age was 59.50 ± 7.92 years (42 - 73 years), 36.37 ± 19.53 years (10 - 77 years), and 37.41 ± 15.18 years (17 - 66 years) in low, medium, and high education level groups respectively. The descriptive data such as mean age, gender, residence, and working status in subjects separated in terms of education level was summarized in table 1.

| | Low Education Level Group | | | Medium Education Level Group | | | High Education Level Group | | |
|--------------------|---------------------------|------|------|------------------------------|------|------|----------------------------|------|------|
| Age (years) | 59.50 ± 7.92 (42-73) | | | 36.37 ± 19.53 (10-77) | | | 37.41 ± 15.18 (17-66) | | |
| Gender (%) | Female | | Male | Female | | Male | Female | | Male |
| | 93.3 | | 6.7 | 56.5 | | 43.5 | 52.3 | | 47.7 |
| Residence (%) | Rural | | City | Rural | | City | Rural | | City |
| | 16.7 | | 83.3 | 1.2 | | 98.8 | 0.0 | | 100 |
| Working Status (%) | UW | W | S | UW | WW | S | UW | W | S |
| | 73.3 | 26.7 | 0.0 | 18.8 | 50.6 | 30.6 | 13.6 | 75.0 | 11.4 |

Table 1: Descriptive data of the subjects among groups with different education level.

UW: Unworked; W: Worked; S: Student.

The mean spherical error was +1.18 ± 1.24 D (-0.50 - +5.50 D) in low education level group, -0.34 ± 1.40 D (-4.50 - +2.50 D) in medium education level group, and -1.44 ± 1.92 D (-7.00 - +2.00 D) in high education level group. There was statistically significant difference between groups (p < 0.001). When comparing of 3 groups with each other, similar statistically significant difference was shown in post-hoc analysis (all p < 0.001). The mean cylindrical error and the axis of the negative cylindrical error were similar in all groups (p < 0.001, p < 0.001). The comparison of refractive errors of the subjects with different education level was summarized in table 2.

| | Low Education Level Group | Medium Education Level Group | High Education Level Group | p value |
|------------------------------------|------------------------------|------------------------------|------------------------------|----------|
| Spherical Error (Diopter) | +1.18 ± 1.24 (-0.50 - +5.50) | -0.34 ± 1.40 (-4.50 - +2.50) | -1.44 ± 1.92 (-7.00 - +2.00) | < 0.001* |
| Cylindrical Error (Diopter) | 0.16 ± 0.90 | 0.40 ± 0.91 | 0.55 ± 0.92 | 0.194 |
| Axis of Negative Cylindrical Error | 53.83 ± 64.99 | 60.18 ± 67.37 | 57.16 ± 71.69 | 0.903 |

Table 2: The comparison of refractive errors of the subjects with different education level.

* $p < 0.001$ in low education level vs. medium education level,

* $p < 0.001$ in low education level vs. high education level,

* $p < 0.001$ in medium education level vs. high education level.

Discussion

The current study designed to investigate of the refractive situations of healthy Central Anatolian population by separated groups in terms of different education level, in various age, gender, residence, and working status. The most important finding of the current study is being different of spherical refractive errors of healthy subjects with different education levels. According to our results, spherical refractive errors shift to myopia with the increase of education level in Central Anatolian population. Similar results have been obtained in various populations such as Australian, Indian, Chinese, and more [8-11].

According to some researchers, myopia is induced by near work especially reading. Near work is an independent cause of myopia [12,13]. Our sample with medium and high education levels, have more myopic refractive error than subjects with low education level. This result corrects the induce of myopia with near work mechanism. On the other hand, this can be related with living in rural environment and aging. Increase of outdoor activities is considered as protector for myopia [14]. Cortical opacities occurred with aging can cause hyperopic refractive error before decrease of BCVA. These mechanisms need to verify with different large sample sized studies testing different hypothesis.

Tan., *et al.* reported that myopia is more prevalent among Singaporean males compared with females [15]. This result should be corrected with studies investigating other populations. Our results partially verify this study because female gender rate is quietly higher in low education level group. The mean spherical refractive error of this group is more hyperopic than medium and high education level groups that contain more male gender rate. Additionally, according to results of Tan., *et al.* study astigmatism is more prevalent in subjects with high education level [15]. We did not found any difference in astigmatism or axis of negative cylindrical error among subjects with different education level.

The subjects with low education level are quietly older than subjects with medium and high education level. Furthermore, almost all of subjects with low education level are female. These results are not surprises, because in developing countries, schooling of children was restricted from various conditions in past. Especially female gender is considered as a disadvantage to get to school. In all education level groups, healthy female subjects coming to ophthalmology department for refractive correction, is more prevalent than male. This result can be explained with 2 different reasons: 1) the working rates of female and male genders are unequal and female subjects have more opportunities to apply to hospital. 2) refractive errors more commonly occur in female. The current study has not been designed to test of these 2 hypotheses and does not consist large subject size sufficiently. In low education level group, the most of subjects have never worked any job and some of them live in rural environment. These rates decrease with the increase of education level.

Conclusion

In conclusion, myopic shift is occurred with increase of education level and according to the best of our knowledge this is the first report revealed this finding in Central Anatolian population. In medium and high education level, female-male numbers are nearly equal, they are younger; they live in city and most of them are working people and students.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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