Individuals with a high refractive error and the learning with an appropriate type of optical corrective aid

(overview essay)

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Abstract: *The aim of this paper is to assess the importance of proper selection of optical corrective aid for individuals with high refractive error which is one of the possible causes of decreased visual acuity and describe the subsequent training needs for propper use of the corrective aid. Reduction of visual functions is a common cause of many limitations in the implementation of individual´s everyday activities and hinders social inclusion.*

Keywords: *a high refractive error, optical corrective aid, education, training, visual impairment*

1 Introduction

There are many causes and ocular conditions leading to decreased visual functions. First, they are congenital or second – of acquired nature and often lead to poor vision that cannot be treated. The loss of vision or limitations of visual functions have an impact not only on the ontogeny of the individual but also on his/her orientation and movement in the living space. The most often conditions develop with age are for example: age related macular degeneration, cataract, glaucoma, etc. Thanks to prevention and screening programmes is the spectrum of these conditions less common. Depending on the type and degree of disability we can often offer treatment to these people and provide them with various optical corrective aids. These will help in space orientation and allow them to see at various distances. On the basis of diagnosed functional disability is then the effort to reach the widest possible inclusion of the person. The aim of the intervention is to make the functioning of visually impaired individuals equal to those without visual impairment. The specialist in low

vision assessment play the most important role in rehabilitation process of people with visual impairment.

One of the main reasons in the incidence of low vision globally is uncorrected refractive error (ametropia). According to recent surveys and updated data from the World Health Organization it is up to 43% of individuals who do not have adequate correction of nearsightedness (myopia), farsightedness (hyperopia) or astigmatism. Small visual impairment and low vision are usually connected to a common term known as low vision. This, together with blindness are then subsumed under the term visual impairment. A high refractive errors cause changes in many aspects of the vision process. Myopia is refractive error where the image of an object is focused in the front of the retina, in the most cases the axial length of the eye is too long. Hyperopia is refractive error where the image is focused behind the retina, eye is too short (Fredrick, 2002). Astigmatism is mostly caused by irregularly shaped cornea or crystalline lens (Severa, Veselý, Beneš, 2016). In all cases these conditions lead to blurred vision at any distance followed by eye discomfort and headaches.

To support people with visual impairments we can recommend and select an appropriate type of optical corrective aids. The most common are glasses (spectacles) which are devices consisting of spectacle frame that holds mounted optical lenses. For correction of high refractive errors we use a special type of lenses with typical characteristics, eg. aspheric surfaces, high refractive index (thinner, lighter), etc. Given properties of spectacle lenses have also their limitations especially in dioptric ranges, diameters and coatings. Glasses are worn to correct the refractive error but also for aesthetic and fashion purposes. They are prescribed by ophthalmologist or optometrist. For visually impaired people glasses also provide magnification.

Optical aids, eg. glasses, are a big challenge, especially for non-wearers, despite the fact they can greatly support their visual functions. But to be a successful wearer needs to follow the advice and recommendations of eye care practitioners. In any social environment, such as the for example school, it is to be kept in mind that the proper use of optical correction aids improve visual function and performance of the individual. From the perspective of a teacher/lecturer is known to direct dependence on the proper development of visual learning. The visual capacity of children is actually learned function, which can have a positive effect on successful support and further learning. Especially by learning in the sensitive phase of psychical development stage (Janková, 2015).

Not always is an appropriate corrective optical aid the only goal. Every individual has to be educated how to use the optical device correctly and practice the correct use. Especially in cases of high ametropia. Special glasses and contact lenses are individual optical corrective and training devices, useful to improve first visual functions, second to develop and coordinate his/her activities. Person using optical aids has to learn how to wear glasses or contact lenses, respectively (Efron, 2010).

Due to visual conditions we also learn how to focus the image of an object onto the foveal areas at retinas, for the best imagination. There is also need to learn adequate hand-eye or leg-eye coordination.

The aim of this research is to describe and show the situation in common population which have decreased their visual functions due to incorrect use of an appropriate optical aids. Our intervention is then the only option of support of visual functions in people with visual impairments.

2 Material and Methods

This randomized study includes 131 individuals, i.e. 262 eyes and were divided into three groups represented by high refractive errors representing myopia, hyperopia and astigmatism. Generally, visual impairment is according to WHO divided into 5 categories. But we decided to compare data of individuals with uncorrected visual acuity ranked as visual impairment (category 1) and severe visual impairment (category 2), ie. VA <6/18-6/60 or <6/60-/3/60. The intention was to conduct an objective measurement of the refractive state of the eye. To measure these values autorefractokeratometer with Placido disc (KR 8100P, Topcon, Japan) was used. Determining the visual acuity (VA) was carried out on a standard investigative 6 m using a projection optotype (ACP-8, Topcon, Japan). The results were recorded and then statistically processed in program Statistica 12, CZ-Czech single-user version, the company StatSoft®, which is available to students and employees of Masaryk University. Then there been recommended an appropriate type of corrective aids to each person. In most cases were made glasses with the advantages of the latest types of lenses and technological procedures in their processing for the correction of a specific and high visual/refractive errors. Great emphasis was also laid on the aesthetics. There were also chosen and fitted contact lenses via an objective measurement of refraction in the above instrument, also were measured keratometry and corneal topography to eliminate corneal distorsions and ectasias. Based on the parameters were then fitted to the appropriate type of spherical, toric or progressive lenses, respectively. In this study there are not included individuals who showed signs of any intervention on the cornea, blepharitis, purulent conjunctivitis or other eye disease. The study adhered to the tenets of the Declaration of Helsinki. Informed consent was obtained before data collection from the adults or guardians as long as subjects fell under the defined study criteria.

3 Results

The taken data show the distribution of high refractive errors in the sample of measured subjects. The aim of this study is to present the visual situation across the

population sample. We did not assess the individual´s visual functions. The cohort of participants consist of 131 individuals (n = 262 eyes), 47 males and 84 females. The average age is 42.5±19.6 years (min. 10 years, max. 95 years, med. 37 years), see *Figure 1: Age distribution*. The entry criteria was uncorrected visual acuity worse than 6/18 (0.30) mostly corresponding to refractive error higher than 4.0 diopters. But this value is very individual. Subjects were divided into three groups depending on the type of their uncorrected objectively measured higher refractive error. The reproducibility of measurements was ensured.

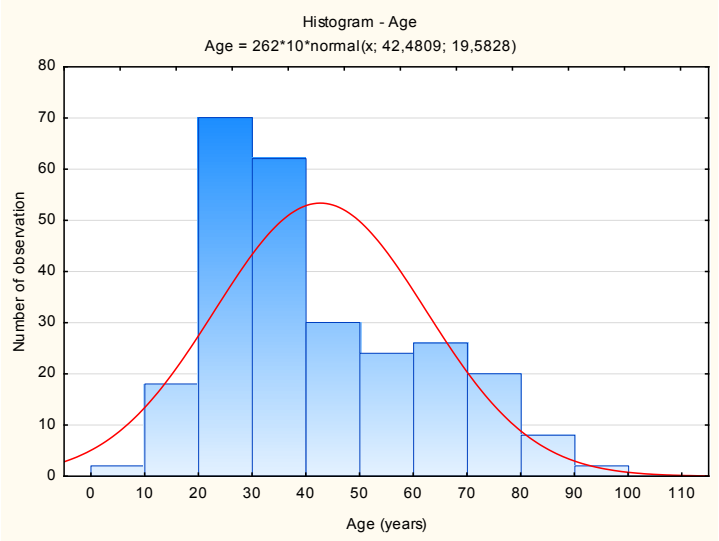

Figure 1: Age distribution

Group I is represented by 47 (n = 94) individuals, 22 males and 25 females with **myopia**. The average of objective refraction is -7.6±2.9 D (min.-4.0 D, max. -20.5 D, med. -6.6 D), see *Figure 2: Myopia distribution*. Average age of this group is 35.4± 14.5 years (min. 14 years, max. 83 years, med. 34 years).

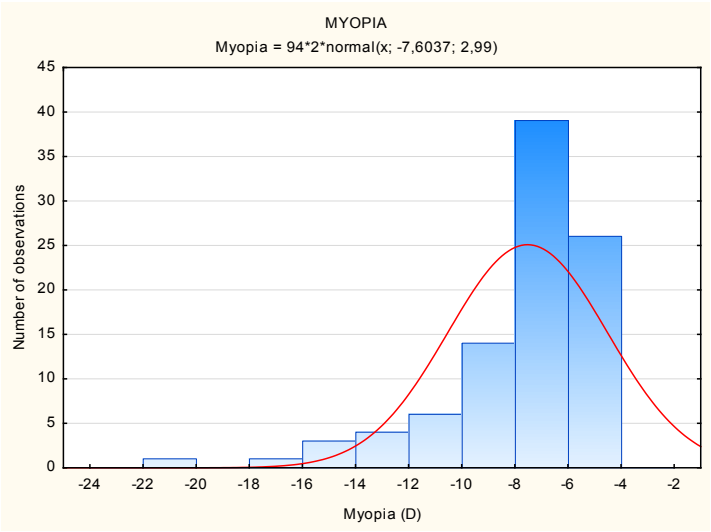

Figure 2: Myopia distribution

In group II is 40 (n = 80) subjects, 15 males and 25 females with **hyperopia**. The average of objective refraction is + 6.16 ± 3.0 D (min. + 4.0 D, max. + 19.0 D, med. + 5.25 D), see *Figure 3: Hyperopia distribution*. Average age of this group is 47.6 ± 20.5 years (min. 10 years, max. 78 years, med. 46 years).

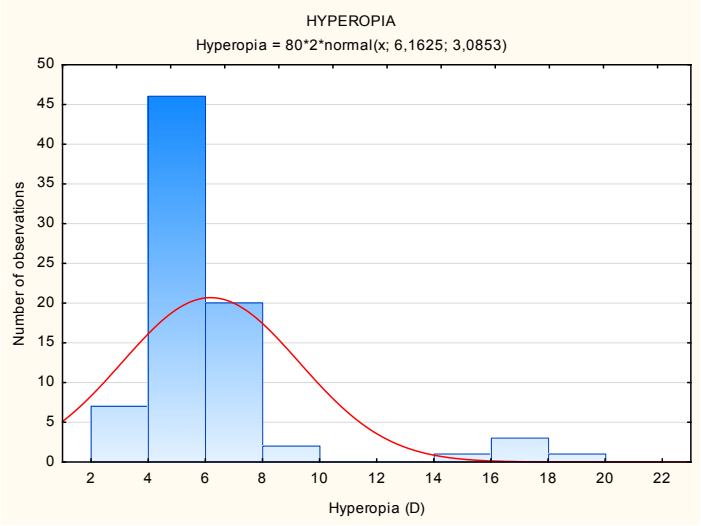

Figure 3: Hyperopia distribution

The group III consists of 44 (n = 88) subjects, 17 males and 27 females with **astigmatism**. For higher validity of the results were as unsuitable individuals chosen with total astigmatism lower than -1.0 D. The average of astigmatic values is -2.62±1.4 D (min. -1.0 D, max. -7.25 D, med. -2.15 D), see *Figure 4: Astigmatism distribution*. Average age of this group is 46.4± 22 years (min. 16 years, max. 95 years, med. 38 years).

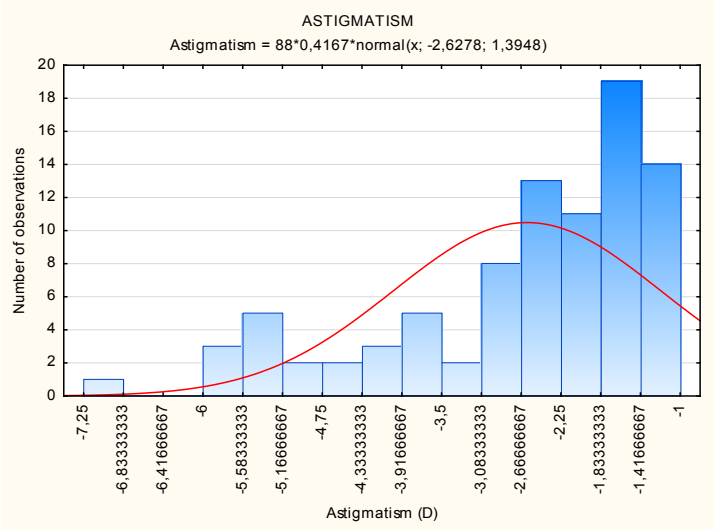

Figure 4: Astigmatism distribution

When we compare all results of high refractive errors will obvious their share in formation of visual image quality and their distribution across the sample of the selected population will be obvious, as we can see in *Figure 5: Sharing of all refractive errors*.

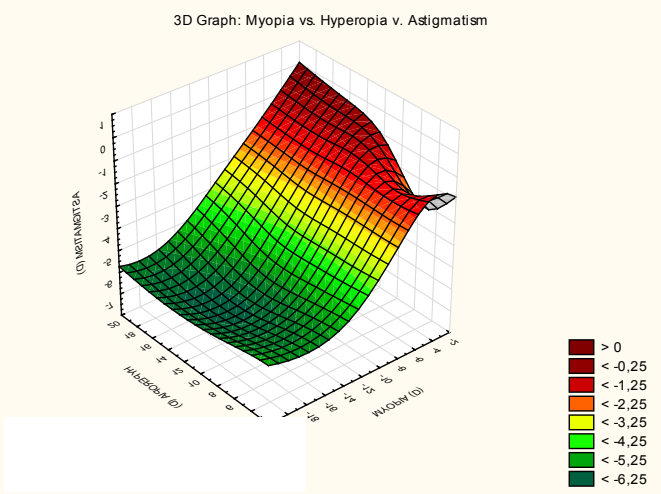

Figure 5: Sharing of all refractive errors

4 Discussion

The distribution of high refractive errors in population is not so common thanks to screening methods and possibilities of refractive surgery, thus refractive errors affect the majority of the population. The most common refractive error in population is hyperopia but is not so often corrected with optical aids as myopia and astigmatism (Verhoeven, 2015, Wolfram, 2014). Our study is also represented by more individuals with myopia. Every individual suffering from high refractive error has affected his/her education skills at different levels (Verhoeven 2013). Education of these persons must be led and formed due their needs and demands. Especially training at near work – writing, reading, etc. has an important role and effect in education process. Proper training and compliance procedures for handling and habituation to visual aids – glasses and contact lenses, is a condition for correct imaging and providing of optical quality image created by corrective optical aid.

5 Conclusion

Appropriate selection and design of corrective aids is often limited. In more complex cases this is not a mere correction of refractive error. Nowadays glasses are not seen as a handicap, but in addition to the correction of high refractive errors, reinforce the individual's own personality with respect to his/her image. There are differences between correction with glasses and contact lenses. Generally, every person wearing contact lenses must have glasses in case of possible eye infection or inflammation.

Advantages of contact lenses are in no limitation of visual field and they are invisible in high ametropia of individuals. Disadvantages of glasses are mostly in image distortions in the optical lens periphery. The aim of eye care practitioners and trainers is to educate individuals with vision loss to increasing the individual's level of independence with activities of daily living, education that have been compromised by visual impairment. We recommend to focus on the proper training and education of people with visual impairments about the correct use of the aids in their own environment. For more complex and detail results, this study will need further research in cooperation with professionals from the field of special education and specialists from rehabilitation centers.

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(reviewed twice)

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