DISORDERS OF SIMPLE BINOCULAR VISION IN HETEROPHORIA AND ITS TREATMENT BY GLASSES CORRECTION

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SUMMARY

This study deals with evaluation of binocular vision in group of young subjects without eye pathology. We examined at whole 68 subjects with average age 26 years, median 24 years. The sample was divided into two main groups. Group A contains subjects with far and near ortophoria (at whole 26 subjects = 38 %). Group B contains subjects with binocular vision disorder (at whole 42 subjects). One subject had strabismus. The most frequent non-strabismus disorder of binocular vision was convergence insufficiency (13 subjects = 19 %), simple esophoria (12 subjects = 17 %) and simple exophoria (8 subjects = 12 %). We decreased average distance heterophoria value (from 1.02 to 0.36 cm/m esophoria) and near heterophoria value (from 0.60 to 0.31 cm/m exophoria) after proper sphere-cylindrical correction. Result of our study shows that adequate and actual sphere-cylindrical correction can reduce disorder of simple binocular vision.

Key words: simple binocular vision, heterophoria, spectacle lenses, convergence insufficiency

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INTRODUCTION

In practice we register a relatively high incidence of non-strabismic disorders of simple binocular vision (SBV). The available literature states incidence at around 80 % [1],[5],[7]. This may concern simple concealed strabismus (exophoria, esophoria), convergence insufficiency or divergence, convergence excess or divergence and disorder of fusional vergence. We usually distinguish simple heterophoria in patients who have approximately the same value of heterophoria for distance and near vision. Patients who have orthophoria in distance vision and exophoria in near vision probably suffer from convergence insufficiency.

Disorders of SBV are usually accompanied by subjective symptoms such as pain or burning of the eyes, increased exertion during detailed close up work or reading, skipping over words during reading, or inability to concentrate on close up work [2]. However, there is also an asymptomatic group, which is statistically less numerous than the group with symptoms [3].

If we suspect a disorder of SBV in a patient, it is necessary to perform a number of basic examinations. This for example concerns examination of visual acuity with and without correction, cover test etc. These and other specific tests for SBV assist us in defining for example the size of the ratio between accommodation and convergence (AC/A ratio), capacity and flexibility of change of accommodation (accommodation facility) and vergence (vergence facility), or focusing of accommodation on a close object (monocular estimation method). With the aid of these tests we can classify the patient within the correct category of SBV disorder, and then better choose and recommend a solution.

Prismatic correction, which has its aesthetic and practical limitations, may not always be chosen as the solution to SBV disorder. It is also possible to recommend special methods of visual training, the aim of which is to normalise the abnormal values of the parameters of simple binocular vision. However, first of all we should take an interest in the sphero-cylindrical glasses correction that the patient uses (or does not use). In the professional literature [9] a positive influence of precise, meaning adequate and up to date, sphero-cylindrical correction, has been demonstrated on reducing complaints upon a disorder of simple binocular vision.

The objective of this study is to determine the incidence of individual types of SBV disorders and demonstrate a positive influence of up to date and adequate glasses correction on these disorders.

METHODOLOGY

Within the framework of the study we had a total of 68 subjects without ocular pathology available. This concerned a total of 60 women and 8 men with an average age of 26 years (minimum 22, maximum 64, SD 9 years, median 24 years). In each subject we measured visual acuity without correction and with their own correction. The average value of visual acuity expressed decimally was 0.86 in the right eye (OD) and 0.89 in the left eye (OS). In the next part of the study we determined best subjective binocular correction and again examined visual acuity. The average decimal value of visual acuity increased in the right eye (OD) to 1.27 and in the left eye (OS) to 1.33.

For each proband we conducted measurement of heterophoria in distance and near vision without correction (or with own correction) and with up to date and adequate correction, which was stipulated with the aim of eliminating disorders of simple binocular vision. In order to measure heterophoria we used the method according to Graefe, with a vertical prism dissociation test and fixation of a single optotype character. From the baseline cohort we excluded subjects without heterophoria in distance or near vision (ortho total 26 probands, see graph 1). In the group of probands with orthophoria we

also additionally detected 4 probands with a disorder of fusional vergence in distance vision. The scope of their fusional vergence in distance vision dropped beneath the normative value according to Morgan [7].

The average value of heterophoria in the selected cohort (41 probands) in distance vision without correction (or with own correction) was 1.02 pD (prismatic dioptres, hereinafter referred to as pD) esophoria and in near vision 0.60 pD exophoria. A subsequent measurement with up to date and adequate glasses correction showed the following average values: heterophoria (esophoria) in distance vision was reduced to the value of 0.36 pD and heterophoria (exophoria) in near vision was also reduced to the value of 0.31 pD.

On the probands we also conducted measurement of the near point of convergence, fusional vergence in distance and near vision with the aid of prismatic strips, binocular accommodative facility with the aid of an accommodation flipper (+/- 2 D) and binocular vergence facility with the aid of a prismatic flipper (3 pD BO/BI). These measurements had already been conducted without correction or with the probands' own correction.

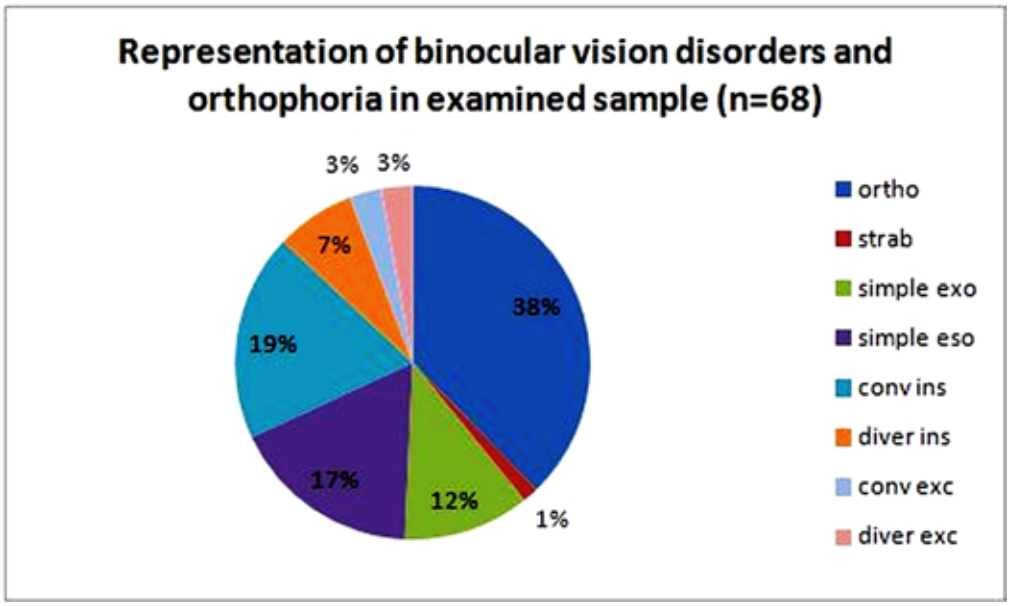
The results were converted into an MS Excel table, and subsequently statistically evaluated using the statistical program Statistika, version 12 from the STATSOFT company, and MedCalc.

RESULTS

On the basis of the used methods and measurements, we divided our cohort into two basic parts and excluded 1 proband with strabismus. Group A consisted of probands with orthophoria (total 26 subjects). Group B comprised probands with a disorder of simple binocular vision (total 41 subjects). In these probands, heterophoria in distance and near vision was demonstrated using the von Graefe method. In group A we also additionally diagnosed 4 subjects with a disorder of vergence in distance vision, which was lower than the normative value according to Morgan [7].

According to our measurement and classification according to Scheiman and Wick [9] we further divided the probands into simple exophoria (8 probands), simple esophoria (12 probands), convergence insufficiency (13 probands), divergence insufficiency (5 probands), convergence excess (2 probands) and divergence excess (2 probands).

The average value of heterophoria in the selection group B



Graph 1 Distribution of disorders of simple binocular vision (SBV) and orthophoria in

Table 1 Statistically insignificant change of heterophoria in distance vision without (FSCD) and with up do date and adequate correction (FCCD).

Variables	Wilcoxon paired test		Statistical level p<0,05	
	Count	T	Z	p-hodn.
FSCD & FCCD	22	67.00000	1.931706	0.053397

Table 2 Statistically insignificant change of heterophoria in near vision without (FSCB) and with up do date and adequate correction (FCCB).

Variables	Wilcoxon paired test		Statistical level p<0,05	
	Count	T	Z	p-hodn.
FSCD & FCCD	20	80.50000	0.914650	0.360376

(41 probands) in distance vision without correction (or with own correction) was 1.02 pD (prismatic dioptres, hereinafter referred to as pD) esophoria and in near vision 0.60 pD exophoria. Subsequent measurement with up to date and adequate glasses correction showed the following average values: heterophoria in distance vision 0.36 pD esophoria and in near vision 0.31 pD exophoria. The average value of original glasses correction of uncorrected refractive condition was in the right eye sphere -0.67 D, cylinder -0.19 D in an axis of 32° and in the left eye sphere -0.62 D, cylinder – 0.19 D in an axis of 26°. After up to date subjective correction these values increased in the right eye sphere to -0.78 D, cylinder to -0.38 D in an angle of 69° and in the left eye sphere to -0.69 D, cylinder to -0.40 D in an angle of 63°.

The results of the measurements therefore demonstrate that a reduction of heterophoria in distance and near vision was achieved with the used glasses correction. For the statistical testing we used a Wilcoxon pair test, which demonstrated that the result was not significant on the selected level of statistical significance (P = 0.05). The results of the test statistics are presented in the tables below.

DISCUSSION

From several well known studies we know that the type of heterophoria is connected with the type of refractive error. Leone, JF et al. [4] in their study on school children demonstrated that upon near gaze in myopic patients there is a predominance of exophoria, and conversely in hypermetropic patients esophoria is more frequent. They also conducted the testing using a cover test.

In a further study [1] it was determined that accommodation disorder may also influence the size of heterophoria.

The results of our study demonstrate that appropriate and up to date correction may have a positive influence on disorders of simple binocular vision. In our cohort of probands with a disorder of simple binocular vision (total 41) a reduction of esophoria was achieved after rounding up by 0.75 pD in distance vision, as well as a reduction of exophoria in near vision after rounding up by 0.25 pD. Although these results are not significant on the selected level of statistical significance, precise correction has a perceptibly positive influence.

Majumder and Ling [5] in their study demonstrated a positive influence of adequate correction of myopia not only on visual acuity but also on heterophoria in distance and near vision. They verified the known fact that insufficient correction of myopia results in exophoria in distance and near vision, and that excess correction of myopia conversely results in esophoria.

CONCLUSION

In our study we divided the baseline cohort of 68 predominantly young subjects without ocular pathology according to their condition of SBV. One subject suffered from strabismus. In 26 subjects we diagnosed orthophoria. This group also included 4 probands with a disorder of fusional vergence. Group B consisted of 41 subjects with a disorder of simple binocular vision. The most frequently occurring condition in this group was convergence insufficiency (19 %), followed by simple esophoria (17 %) and simple exophoria (12 %). Upon use of precise glasses correction we achieved a reduction of the average value of heterophoria in distance vision by 0.75 pD and in near vision by 0.25 pD in these subjects. This reduction is not significant on the selected statistical level of significance (P = 0.05).

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