ORIGINAL ARTICLE

Simple Binocular Vision Evaluation on Healthy Adult Subjects with Synoptophore

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SUMMARY

Purpose: The main goal of our study was to determine the database of parameters of simple binocular vision (SBV) in healthy adult population. Next goal was to verify current data of particular parameters of SBV. Recent public data (e.g. Divisova, Hromadkova) were determined without proper specification of examination (size of fusion object), or are too diffused (e.g. from 15 to 25 prismatic diopters = pD). At last we want to prove, if there are some other factors, which could influence parameters of SBV.
Methods: We had 74 subjects (64 women, 10 men) without significant eye pathology with average age of 24.82 years (max. 28 years, min. 22 years, SD 2.5 years). Particular parameters of SBV were examined without corrective lenses by emetropes, but with habitual correction by ametropes all on Sbisa synoptophore. We measured minimally 16 parameters of SBV, which were note in centimeters (pupillary distance) and in prismatic dioptres (deviation, fusion range and so on). These data were than statistically processed with program MS Excel and with Statitstika version 10. Level of statistical significance was set on p = 0.05.
Results: We got, thanks our study, these significant average results: Subjective deviation for far of all 74 subjects was count to 2.78 ± 3.65 pD, of women was 2.90 ± 3.69 and only for men was 2.00 ± 3.49. This result probably shows inadequate elimination of proximal convergence with the instrument. According our measurement of positive fusion range of all subjects is 25.10 ± 12.77 pD and negative fusion range -6.45 ± 4.18 dD, accommodation convergence to accommodation ration (AC/A) is 3.41 ± 1.47 pD a subjective deviation by accommodation on 33 cm (with minus 3 D) is 13.02 ± 5.23 pD. Further we proved statistical significant correlation between these parameters of SBV: Age and AC/A, SU-3 and AC/A, SU0 and SU-3, SU-3 and FS0 and FS-3. We didn't find any statistical significant differences, when we compared SBV parameters between emetropes, hypermetropes and myopes. The same results we got (except of pupillary distance), when we compared data divided according to gender.
Conclusion: In our study we set the normative average data of SBV parameters, which were measured on healthy adult emetropes and ametropes with habitual correction. We also find how parameters influence each other. All SBV parameters differ on statistical significant level, when we compared them with respect to refractive state and gender. Knowledge of basic SBV parameters is important not only for ophthalmologist but also for optometrists. They can influence these in that way, which can bring comfortable SBV. The most frequent optometric methods are proper sphere-cylindrical correction, prismatic correction and visual training.

Key words: simple binocular vision, synoptophore, subjective deviation, positive fusion range, negative fusion range, accommodation convergence to accommodation ration, pupillary distance

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INTRODUCTION

Simple binocular vision (SBV) is a co-ordinated sensorimotor activity of both eyes, which together with fusion leads to the formation of simple spatial perception. Binocular vision is not innate. The development of SBV is linked amongst other factors to the development of visual acuity. In newborns the fixation of the eye is not yet fully developed, and the light source is traced by uncoordinated conjugated movements of both eyes. In the 2nd month of life fixation becomes active, and from the 3rd month central fixation is incipient. At the same time disjunctive movements begin to appear (convergence and divergence). From the 4th month onwards, the infant begins to accommodate. In the 3rd annual quarter of life the infant is capable of fusion and at the end of the 1st year of life the binocular interplay of the eyes is improved also due to incipient walking (spatial vision develops) [1].
The conditions for normal development of SBV can be divided into two main groups. The sensorimotor group

covers normal or almost normal vision of both eyes (good visual acuity), approximately identically large retinal images of both eyes, joint perception by both eyes and sufficient development of the fusion apparatus. The second, motor group covers approximately identical parallel position of the eyes upon distance view, free movement of the eyeballs and coordination of accommodation and convergence.

SBV can be divided into three degrees. These are simultaneous vision or superposition, fusion and stereopsis. Simultaneous vision means an ability to perceive simultaneously with the retinas of both eyes. For example, in the case of synoptophore/troposcope this means covering one image (lion) with another (cage). The result may be either superposition or diplopia (crossed, uncrossed). Fusion is the ability to join the same image of the right and left eye in a single perception. This is possible only in the case that all the above sensoric and motoric preconditions are met. Fusion requires the fusion movement of the eye (by at least 4 to 5°). We distinguish sensoric fusion, which is a psychological phenomenon and occurs even without the movement of both eyes, and motoric fusion, which controls the axes of the eyes in such a manner that they traverse in the place of the fixed object. According to Duke-Elder [2], the normal fusion range in a horizontal direction is 30° to convergence, 5 to 8° to divergence and 3 to 6° in the vertical axis and 12 to 20° around the sagittal axis (torsional vergence). Hurt et al. [3] state virtually identical values, but in prismatic dioptres (pD). Upon measurement of fusion range, we determine a degree of convergence and divergence in which the simple binocular image disintegrates. We can also evaluate the strength of fusion according to the speed and ease of joining diplopic images. Fusion is a guarantee of SBV. Stereopsis is possible only in a certain, limited three-dimensional space in front of and behind a fixation curve (horopter). This is known as Panum's fusional space. According to Parks [4], the minimum horizontal disparity which generates stereopsis is 14 angular seconds. The quality of spatial perception depends amongst other factors on the quality and extent of the fusion. As a result it is important to know this SBV parameter [1].

Pathologies of SBV include suppression, amblyopia and anomalous retinal correspondence (ARC). Suppression is the inhibition of perception, thus preventing perception in the excursive eye. "Suppression scotomas" (central, peripheral) form, which can also be demonstrated by perimetry/campimetry. Amblyopia (blunted vision) indicates reduced vision of the eye, in which we cannot objectively demonstrate any anomalies. There are various types of amblyopia, e.g. amblyopia ex anopsia, congenital, anisometropic, meridional, ametropic, relative and amblyopia in strabismus. According to the degree of reduction of visual acuity, it is possible to distinguish between severe (up to vision of 0.1), medium and slight (vision from 0.4 to 0.8). ARC is a sensoric adaptation of SBV to a motoric anomaly of strabismus. This is an issue of the cortical visual area, not the retina. In principle it consists in the fovea of the leading eye and the area of the retina of the abnormal eye gain a common spatial localisation an create a new retinal image. We distinguish between two forms of ARC: harmonic (HARC) and disharmonic (DARC). In the case of HARC, the angle of the anomaly is equal to the objective angle of strabismus. In the case of DARC the angle of the anomaly is smaller than the objective angle of strabismus. In order to determine the size of the angle of anomaly (AA), we must know the size of the objective angle (OA) and the subjective angle (SA). The smaller the AA, the more NRC predominates [1].

A synoptophore (troposcope, amblyoscope, haploscope) is an instrument used for therapeutic and diagnostic purposes in the case of SBV. It is based on the principle of mechanic controlled dissociation of the right and left eyes. The first haploscope was used in the 19th century by E. Hering. At the beginning of the 20th century an instrument (amblyoscope) was used by C. Worth for compensation of horizontal and vertical anomalies in strabismus. In 1931 M. Maddox, E. Maddox' daughter, defined the use of the troposcope. She introduced 3 units of SBV and their exercises. In Great Britain (GB) this instrument is better known as a synoptophore and in the USA rather as a troposcope [4, 5].

A synoptophore is composed of a base, onto which two horizontally rotating arms are attached. A rest for the patient's chin and forehead is placed on the base. The lower part of the base contains a set of screws (e.g. setting PD) and buttons for adjusting the instrument and controlling the light sources located in the arms of the instrument. The tubes of the arm contain semi-permeable slides (beam divider) and connecting lenses with

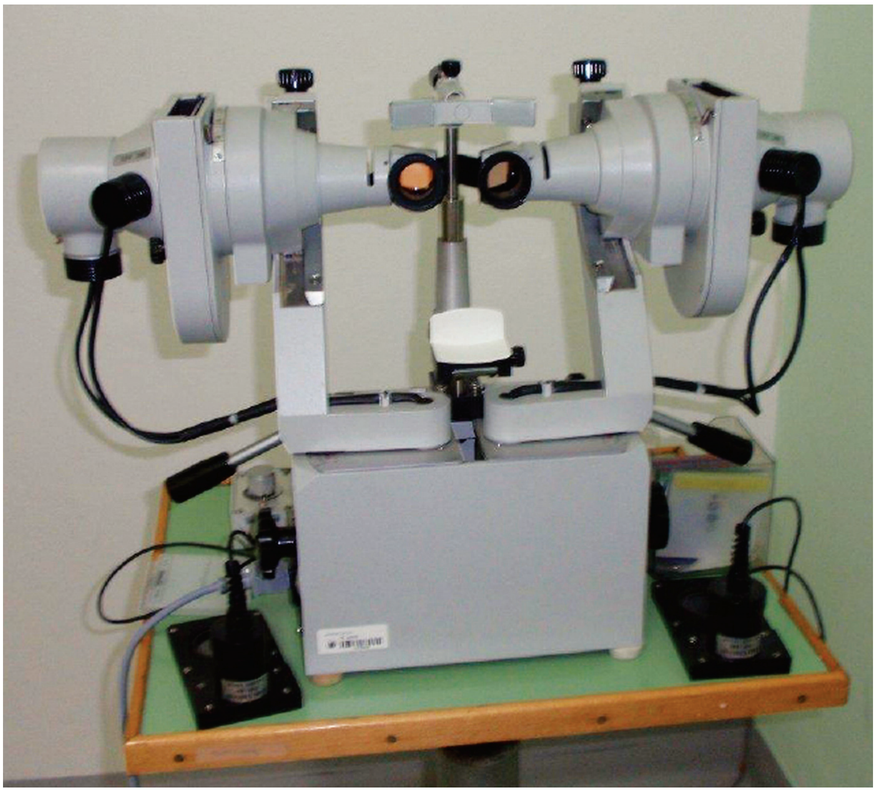


Fig. 1 Sbisa synoptophore

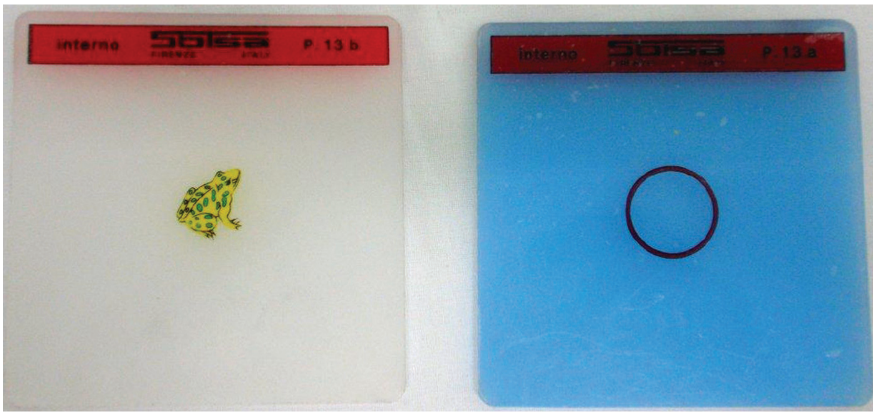


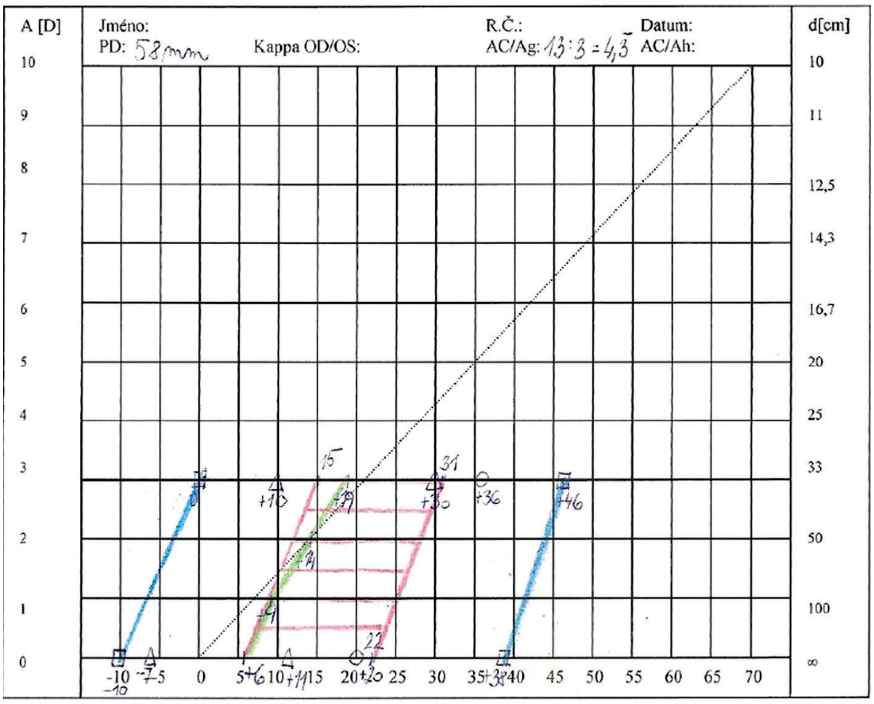
Fig. 2 Images for superposition on synoptophore

Fig. 3 Images for examination of fusion on synoptophore

peak refractivity of +8D, which are intended to eliminate “proximal convergence”. The angle of rotation of each arm can be read on a scale either in angular scales or in prismatic dioptres (pD), in which 1° is approximately equivalent to 2 pD. On the arms we also find a vertical scale for measurement of the vertical fusion range and vertical anomalies. It is also possible to us the instrument to measure an examine cycloversion. The instrument may also feature a device for projection of “Haidinger’s brushes”, which serves for the examination of eccentric fixation (EF). Diagnostic images are used for examination of SBV. We divide images according to type (for superposition, fusion and stereopsis) and size (foveolar, macular and paramacular). For examination of superposition we use dissimilar images (see fig. 2), for fusion similar images (see fig. 3) and for examination of stereoscopic vision dissociated images (see fig. 4).

On the synoptophore SBV is examined in the patient, with correct subjective refraction and without. The patient is sat comfortably behind the instrument and the pupillary distance (PD) is set. The correct position of the eyes is examined according to corneal reflexes (CR). All the scales on the instrument are set at zero at this point. First of all the objective anomaly (OA) of strabismus is determined. Upon alternating flashing lights in the arms, the arms of the instrument are moved in the direction of the anomaly until the backward movement of the eye ceases. The resulting rotation of the arm shows the direct OA in degrees or pD. There follows determination of the subjective anomaly (SA). The SA is an angle which is read on the scale at the moment when the patient sees superimposed dissimilar images. If the OA and SA differ by more than 3°, this probably represents a case of ARC. The coincidence of retinas can be verified using the Hering-Beilschovsky after image test. There follows examination of fusion. The patient should be able to see similar images correctly for fusion. The arms of the instrument are subsequently rotated first in the direction towards convergence, then to divergence, and the defocusing point (BLP), bifurcation point (BRP) and reconnection point (RP) are sought. The fusion range should be largest to convergence and smallest in the vertical direction. Upon further examination dissociated images are used, which enable us to determine whether or not the eyes have stereoscopic vision [5]. It is also possible to use the synoptophore to conduct a “heterephoria analysis” [6]. The values of relative convergence and relative accommodation can be determined and measured, as well as fusion range (strength) upon distance and close-up view and the accommodation convergence to accommodation ratio (AC/A), which has a significant influence on the quality of SBV. In SBV a certain degree of convergence corresponds to a certain degree of accommodation. This relationship can be expressed graphically by the Donders’ line. Accommodation can be increased on the synoptophore by introducing dispersive lenses. The AC/A gradient (AC/Ag) is measured by this method. Graph 1 displays a heterophoria analysis on an example of a young adult male hypermetropic patient without ocular pathologies. PD of the patient is 5.8 cm and his distance SA is 6 pD. Near SA (33 cm, 3 D accommodation) should therefore theoretically be almost 18 pD. We me-

Fig. 4 Images for examination of stereopsis on synoptophore



Graph 1 Heterophoria analysis in hypermetropic patient without symptoms of ocular pathology [5]

asured 19 pD, and from this it ensues that AC/Ag is 4.3 pD on 1 D accommodation (4.3 : 1).

METHODOLOGY

We examined SBV on a synoptophore in 74 subjects, of whom 64 were women and 10 men. The examination took place on healthy subjects (without symptoms of ocular pathology, emetropes, ametropes with habitual correction) without the use of diagnostic pharmacological agents under standard lighting conditions at various times of the day. We used a synoptophore produced by the Sbisa Company for the examination (see fig. 1).
In total we therefore obtained data from 74 subjects. The values were measured predominantly in cm (pupillary distance) and in prismatic dioptres (deviation, fusion range) rounded up to two decimal places. The data was processed by the statistical program STATISTICA version 10 and the program MS EXCEL in version 2007. In order to the determine normality of the data we used normality tests (Lilliefors, Shapiro-Wilks). With regard to the fact that a more significant difference from normality ($p < 0.01$) was found with certain data, we decided to use nonparametric tests (Spearman's correlation test) for a comparison of individual methods. Thanks to the normality of the data, we were able to use a parametric T test (for independent variables) for a comparison of the data obtained from women and men. The statistical level of significance in all cases was set at $p = 0.05$.

Table 1 SBV parameters in all subjects

SBV PARAMETER	Value, SD and unit
Pupillary distance (PD)	6.02+/-0.29 cm
Subjective deviation to distance (SU0)	2.78+/-3.65 pD
Defocusing point to distance nasally (BLP0)	19.04+/-9.48 pD
Bifurcation point to distance nasally (BRPN0)	25.10+/-12.77 pD
Bifurcation point to distance temporally (BRPT0)	-6.45+/-4.18 pD
Reconnection point to distance nasally (RPN0)	10.54+/-8.04 pD
Reconnection point to distance temporally (RPT0)	-1.3+/-3.71 pD
Subjective deviation to close-up (SU-3)	13.02+/-5.23 pD
Defocusing point to close-up nasally (BLP-3)	35.54+/-12.20 pD
Bifurcation point to close-up nasally (BRPN-3)	42.09+/-15.14 pD
Bifurcation point to close-up temporally (BRPT-3)	-0.90+/-6.77 pD
Reconnection point to close-up nasally (RPN-3)	24.06+/-12.23 pD
Reconnection point to close-up temporally (RPT-3)	8.01+/-7.90 pD
Accommodation convergence to accommodation ratio (AC/A)	3.41+/-1.47 pD
Fusion range to distance	31.56+/-12.30 pD
Fusion range to close-up	42.74+/-15.30 pD

RESULTS

We measured the individual physiological parameters of SBV in 74 subjects, with an average age of 24.82 years (max. 28 years, min. 22 years, SD 2.5 years). In total we had 78 subjects available (women and men) without symptoms of ocular pathology, in whom we stipulated the average parameters of SBV presented in table 1.
The normative values of SBV stipulated in the group of women without ocular pathology (n = 4, average age 24.82+/-2.50 years) are presented in table 2.
The normative values of SBV stipulated in the group of men without ocular pathology (n = 10, average age 25.90+/-1.10 years) are presented in table 3.
In the baseline group (women and men) we also demonstrated the correlations presented in table 4 using a non-parametric test (Spearman's test).
In the next part of the study we divided the baseline group according to refractive defect. In the group of emetropes there was a total of 9 subjects, in the group of hypermetropes there was a total of 4 subjects and in the group of myopes there was a total of 10 subjects. Using a parametric T-test we determined whether the selected parameters of SBV differed from one another in the individual groups, divided according to refractive defects (see table 5).
In the following part of the study we again divided the baseline group according to sex (64 women, 10 men), and using a parametric T-test we determined whether the selected parameters of SBV differed from one

Table 2 SBV parameters in women

SBV PARAMETER	VALUE, SD AND UNIT
Pupillary distance (PD)	5.97 +/- 0.29 cm
Subjective deviation to distance (SU0)	2.90 +/- 3.69 pD
Defocusing point to distance nasally (BLP0)	19.08 +/- 9.69 pD
Bifurcation point to distance nasally (BRPN0)	25.20 +/- 12.99 pD
Bifurcation point to distance temporally (BRPT0)	-6.21 +/- 4.26 pD
Reconnection point to distance nasally (RPN0)	10.50 +/- 7.89 pD
Reconnection point to distance temporally (RPT0)	-1.13 +/- 3.72 pD
Subjective deviation to close-up (SU-3)	12.93 +/- 5.01 pD
Defocusing point to close-up nasally (BLP-3)	35.14 +/- 12.35 pD
Bifurcation point to close-up nasally (BRPN-3)	42.59 +/- 14.94 pD
Bifurcation point to close-up temporally (BRPT-3)	-0.82 +/- 6.91 pD
Reconnection point to close-up nasally (RPN-3)	24.30 +/- 11.82 pD
Reconnection point to close-up temporally (RPT-3)	8.34 +/- 7.92 pD
Accommodation convergence to accommodation ratio (AC/A)	3.34 +/- 1.49 pD
Fusion range to distance	31.42 +/- 12.54 pD
Fusion range to close-up	43.12 +/- 15.04 pD

Table 3 SBV parameters in men

SBV PARAMETER	VALUE, SD AND UNIT
Pupillary distance (PD)	6.32+/- 0.31 cm
Subjective deviation to distance (SU0)	2.00+/- 3.49 pD
Defocusing point to distance nasally (BLP0)	18.00+/- 0.00 pD
Bifurcation point to distance nasally (BRPN0)	24.50+/- 11.86 pD
Bifurcation point to distance temporally (BRPT0)	-8.00+/- 3.43 pD
Reconnection point to distance nasally (RPN0)	10.77 +/- 9.56 pD
Reconnection point to distance temporally (RPT0)	-2.44 +/- 3.67 pD
Subjective deviation to close-up (SU-3)	13.60 +/- 6.76 pD
Defocusing point to close-up nasally (BLP-3)	44.00 +/- 0.00 pD
Bifurcation point to close-up nasally (BRPN-3)	38.90 +/- 16.87 pD
Bifurcation point to close-up temporally (BRPT-3)	-1.40 +/- 6.13 pD
Reconnection point to close-up nasally (RPN-3)	22.60 +/- 15.17 pD
Reconnection point to close-up temporally (RPT-3)	5.66 +/- 7.77 pD
Accommodation convergence to accommodation ratio (AC/A)	3.86 +/- 1.27 pD
Fusion range to distance	31.50 +/- 11.22 pD
Fusion range to close-up	40.30 +/- 17.53 pD

Table 4 Correlation of certain SBV parameters in all subjects

PARAMETER 1	PARAMETER 2	NUMBER N	SPEARMAN R	P-VALUE	CORRELATION
Age	AC/A	74	0.273	0.018	YES
SU0	AC/A	74	-0.103	0.378	NO
SU-3	AC/A	74	0.717	<0.001	YES
PD	SUO	74	-0.226	0.052	NO
SU0	SU-3	74	0.559	<0.001	YES
SU0	FSO	74	0.182	0.118	NO
SU-3	FS-3	74	0.26	0.024	YES
FS0	FS-3	74	0.585	<0.001	YES

another in the individual groups (see table 6).

DISCUSSION

The aim of our study was to establish a normative database of standard parameters of SBV. At present various authors state various values of the extents e.g. of fusion ranges, accommodation convergence and accommodation ratio etc.

In her publication, Divišová [1] presents values of AC/A in the healthy population from 2 to 5 pD at one accommodation dioptre. However, she stresses that the values may fluctuate more. The values of the positive part of the fusion range in the horizontal direction (in our case BRPN0) are from 15 to 25 pD in the healthy population according to Divišová, and the negative part of the fusion range (in our case BRPT0) is from -6 to-12 pD in the healthy population. Divišová further states the following: "In practice these two values, in particular in the direction to convergence, are markedly higher." However, our results do not correspond with this assertion (BRPN0 = 25.10 ± 12.77 pD and BRPT0 = 6.45 ± 4.18 pD). Divišová notes that the size of the measured fusion range differs according to age, attention, training, accommodation of fused objects and according to the method of examination. "On the troposcope/synoptophore the usual values of fusion range are higher to close-up than to distance, since the instrument convergence is applied," states Divišová.

Hromádková [7] states in her publication that the normal positive fusion range is up to 30° (approx. 60 pD), the negative fusion range up to 8° (approx. 16 pD) and the vertical fusion range 3° (approx. 6 pD). However, with regard to our measurement, these values strike us as substantially overestimated (by 59% for positive fusion range and by 63% for negative fusion range). The fusion range also depends on the size of the images

Table 5 Differences in certain SBV parameters according to type of refractive defect (using T-test)

PARAMETER 1	PARAMETER 2	T VALUE	P VALUE	DIFFERENCE
EM-ACA	HY-ACA	-0.539	0.600	NO
EM-ACA	MY-ACA	-0.685	0.502	NO
HY-ACA	MY-ACA	0.090	0.929	NO
EM-BRPN0	HY-BRPN0	0.046	0.963	NO
EM-BRPN0	MY-BRPN0	-0.423	0.677	NO
HY-BRPN0	MY-BRPN0	-0.327	0.748	NO
EM-BRPN-3	HYBRPN-3	0.738	0.475	NO
EM-BRPN-3	MY-BRPN-3	0.059	0.953	NO
HY-BRPN-3	MY-BRPN-3	-0.497	0.628	NO
EM-BRPT0	HY-BRPT0	-1.983	0.072	NO
EM-BRPT0	MY-BRPT0	-1.507	0.150	NO
HY-BRPT0	MY-BRPT0	0.741	0.472	NO
EM-BRPT-3	HY-BRPT-3	-1.271	0.229	NO
EM-BRPT-3	MY-BRPT-3	-0.397	0.695	NO
HY-BRPT-3	MY-BRPT-3	0.711	0.490	NO
EM-SU0	HY-SU0	-1.423	0.182	NO
EM-SU0	MY-SU0	-0.614	0.547	NO
HY-SU0	MY-SU0	1.006	0.333	NO
EM-SU-3	HY-SU-3	-1.956	0.076	NO
EM-SU-3	MY-SU-3	-1.178	0.254	NO
HY-SU-3	MY-SU-3	0.792	0.443	NO

Table 6 Differences in certain SBV parameters according to sex (using T-test)

PARAMETER 1	PARAMETER 2	T VALUE	P VALUE	DIFFERENCE
PARAMETER 1	PARAMETER 2	T VALUE	P VALUE	DIFFERENCE
PDZ	PDM	-3.714	□0.001	YES
SU0Z	SU0M	0.726	0.469	NO
BRPN0Z	BRPN0M	0.16	0.872	NO
BRPT0Z	BRPT0M	1.256	0.212	NO
SU-3Z	SU-3M	-0.379	0.712	NO
ACAZ	ACAM	-1.045	0.299	NO
FS0Z	FS0M	-0.255	0.798	NO
FS-3Z	FS-3M	0.54	0.590	NO

used. In the case of large images we examine peripheral fusion and the extent of the fusion range could be from -3° to +25°. Upon determining the fusion range we used images corresponding to macular fusion. According to Hromádková, the extent of macular fusion should be from -2° to +15°. We can state that these values more or less correspond with our data (BRPN0 = 25.10 ± 12.77 pD and BRPT0 = -6.45 ± 4.18 pD). Upon an evaluation of fusion range it is therefore important, in addition to the used method, to state also the size of the fusion stimuli.

We can also measure fusion range using prismatic lenses (slides). The patient fixes on a light source at a distance of 5 m. We progressively introduce prisms with an increasing prismatic effect. We measure the positive fusion range using prisms with an outward base and the negative range using prisms with an inward base. We magnify the prisms until diplopia ensues. According to Hromádková, a healthy person has a positive fusion range of 25-40 pD, a negative fusion range of 8-10 pD and a vertical fusion range of 3-4 pD. These values also correspond with our measurement on the synoptophore (BRPN0 = 25.10 ± 12.77 pD and BRPT0 = -6.45 ± 4.18 pD).

On a group of 132 patients, upon examining fusion ranges on a synoptophore, Adamek and Karczewicz [8] determined that there is a difference between the extent of the fusion range in the right and left eye. In total, in 35.6% of patients there was a difference between the fusion range of the right and left eye to close-up upon convergence, in 34.4% patients there was a difference between the fusion range of the right and left eye to distance upon convergence, and in 65.6% of patients there was a difference between the convergent fusion range of the right and left eye.

The quality of SBV can also be determined using a vergence facility (VF), in which 12 pD with an outward base and 3 pD with an inward base are placed alternately and the number of cycles per minute are counted. According to Melville [9] the standard VF value to close-up (1/3 m) is 12 ± 4.2 cpm. However, in her study the author did not demonstrate a connection between fusion range to close-up and VF.

In their study (20 normal individuals with visual acuity of 6/6 without pronounced refractive defects), in which they examined the influence of the size of fusion range on the quality and maintenance of SBV using aniseikonic patterns, Sharma and Prakash [10] measured the following average values on a synoptophore: adduction vergence (positive fusion range) 15.2 pD and abduction vergence (negative fusion range 5 pD. They also measured the extent of adduction vergence from 2 to 6 pD (average 2.92 pD) and the extent of abduction vergence from 1 to 3 pD, with an average of 2.16 pD using a special projection facility with polarisers at a distance of 5 metres. The values of positive and negative fusion range measured on the synoptophore are lower (by 40% and 23% respectively) than the values measured in our group. The authors of this study also determined that 70% of subjects are able to tolerate 30% aniseikonia in the short-term, and that a higher extent of fusion range does not have a particularly significant influence on the increase of this ability.

CONCLUSION

Knowledge of the normal (standard) parameters of SBV is important not only for ophthalmologists/strabologists, but also for optometrists who may significantly influence these SBV parameters in adult patients without pathological ocular manifestations in such a manner as to produce a result of comfortable simple binocular vision. The most frequently used optometric methods include correct spherocylindrical correction, prismatic correction and visual training.

In our study we attempted to establish the normal values of certain SBV parameters in healthy young adult subjects without pronounced ocular pathologies overall, and subsequently in men and women separately. We also demonstrated a statistically significant correlations between certain SBV parameters (age and AC/A, SU-3 and AC/A, SU0 and SU-3, SU-3 and FS3, and FS0 and FS3). By contrast we did not demonstrate statistically significant correlations in the following SBV parameters: SU0 and AC/A, PD and SU0, and SU0 and FS0. We did not demonstrate that individual SBV parameters differ between hypermetropes and myopes on a statistically significant level. We also did not demonstrate statistically significant differences in SBV parameters between men and women (with the exception of PD). These results may however be influenced by the small number of subjects in the group of men.

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