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Physical activity and Short-Sightedness in Student Population

A Retrospective and Prospective Study

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ABSTRACT

Aim *To conclude the connection between physical activity and shortsightedness advancement in student population. Originator of shortsightdness development are not made clear sufficiently.*
Methods *This study contained 100 students with confirmed shortsightdness up to -3 Dsph. The study was administered in the Vibhuti Narayan Government Inter College in the period from July 2015 until November 2015. Eye examination and Multistage Fitness Test were done two times.*
Results *A compelling interaction was documented only conferring to evaluation of physical ability during the second appraisal with a negative sign, signify that an increase of physical activity had an impact on the decrease of differences in values of cycloplegic automatic computer refractometry analysis (right eye Rho: -0.260, p<0.01; left eye Rho: - 0.255, p<0.05). Multivariate regression analysis of impact on the dissimilarity of distance visual acuity outside correction as well as the impact on difference of cycloplegic automatic computer refractometry pointed out that evaluation of physical ability during the analysis had statistically meaningful impact on the reduce of distance visual acuity between analysis (right eye OR: I calculation -0.748, II calculation -0.660, p<0.05; left eye OR: I measurement -0.613, II measurement -0.515, p<0.05) and on reduced difference of cycloplegic automatic computer refractometry (right eye OR: I measurement -0.822, II measurement -0.831, p<0.05; left eye OR: I measurement -0.641, II measurement -0.706, p<0.05).*
Conclusion *Physical activity did not originate the increase of shortsightdness. This study opened a perspective for other studies on the impact of physical activity on shortsightdness.*

Key words: Functional ability; Multistage Fitness Test; Myopia; Ophthalmological examination.

INTRODUCTION

Shortsightdness is a refractional deviation where the parallel rays coming from the distance, following the refraction over the cornea and the lens, spotlight before retina in the vitreous humour and by coming before the focus in divergence state; they build scatter circles on retina with cloudy image of the subject that is located in infinity[1]. Causes of shortsightdness have not been sufficiently confirmed[2]. There are several issues expanded as the originator of shortsightdness, such as heredity, malnutrition, obesity, endocrine chaos, chemical shortfall (calcium, vitamin deficit), too much or insufficient use of spectacles, too much during near-sighted activities[3]. Most common theories relating to hereditary and circumstantial determinants, working settings and near- sighted work, as well as their combinations were established before[1,2] . In the children and adolescent with shortsightdness who were regularly engaged in sports and other physical activities, it was identified that myopia did not increase at later age[4]. It has been observed that young people with myopia reported less physical exercise and activity in childhood than their age peers[5-7]. Shortsightdness is classified according to etiology (cause), clinical features, age at which it occurs, the intensity of optical error, the amount of refraction[8-10]. The desire of this study was to identify the connection between physical activity and progressive shortsightdness in student population. Previous studies found that physical activity has a protective effect on the development and progression of shortsightdness in college students.

PATIENTS AND METHODS

The study included 100 students of the Vibhuti Narayan Government Inter College, of both genders, 18 to 25 years of age with proved shortsightdness up to -3 Dsph earlier to coming the faculty, where an optical adjustment as well as the absence of general, systemic diseases in the plan of study was determined. In addition to shortsightdness up to -3 Dsph, depending on entrenched disease, forbiddance benchmarks were a presence of any other eye disease as well as any eye surgery. Examinees deliberately engaged in the study which was proved following detailed information on the purpose and manner of carried out the study by signing the consent on attendance in the study. The rule of conducts of this study complies with principles of the Declaration of College. The study was backward-looking-potential, explanatory and achieved in the course between the starting of January 2011 just before the end of January 2012. Eye checkup and evaluation of the level of physical activity (physical competence/functional ability) were done.

Eye checkup was done in the Eye department of Civil Hospital, Gyanpur, two times during academic years 2015, at the end of the summer session of the year 2015. It included determining of distance visual acuity outside adjustment, biomicroscopic examination of the anterior segment of eye, determining of refraction at cycloplegia and finding at the ocular fundus. Questionnaires used in this study consisted of the question how many hours per week examinees spent in sports and physical activities. Physical activity (physical competence/functional ability) of examinees was determined with Multistage Fitness Test (Brewer J), according to the protocol[11]. Prior to performing the test ourselves, the ensuing anthropometric parameters were measured: body height, body mass and Body Mass Index (BMI). The aforementioned test was done in the gym at the same time as ophthalmological examinations.

Necessary equipment for performance of Multistage Fitness Test included a CD player and 2 signs 20m apart. The test begins by start of counting down lasting for 5 seconds (s). Afterwards, individual signals were issued in equal intervals. Examinees should seek to be on the opposite side from the start in the moment when the first sound signal was heard. Examinees should continue to run with the same pace and be at one or the other end of the road every time when the following sound signal was heard. After each minute, time intervals between sound signals decreased and therefore, the running speed inevitably increased. The first running speed was marked as level 1, the second as level 2 and so on. Each level lasted in average for about 1 minute and duration of the CD was up to level 21. If examinees failed to reach the line before the sound signal, they got 2 verbal warnings and following a third one, the test was suspended. The observer-partner marked the levels and number of run tracks within each level in order to determine the number of tracks of examinee prior to the test suspension. Obtained results were entered in a form for the checking of morphological and functional abilities. Data were processed by applying descriptive statistics, t-tests for independent samples, chi-squared test, Pearson's test of linear equivalence and multivariate regression inquiry. The $p<0.05$ was considered as statistically significant.

RESULTS

There were greater female, 61 (61%) in connection to male, 39 (39%) examinees. An average examinees age was 21.89±1.49 years (categorized from 20-25). The contrasting of distance visual acuity outside adjustment of the right eye shows that in case of the first calculation it was 0.5224±0.3, and in case of the second calculation, 0.4746±0.3 ($p<0.05$). A distance visual acuity outside adjustment of the left eye in case of first calculation was 0.5389±0.3, and in the second calculation 0.4865±0.3 ($p<0.05$). Cycloplegic automatic computer refractometry of the right eye in the first calculation was -1.3275±0.61 Dsph and in second one was -1.455±0.64 Dsph ($p<0.05$). Cycloplegic automatic computer refractometry of the left eye in the first calculation was -1.2875±0.64 Dsph, and in the second one it was -1.4025±0.69 Dsph ($p<0.05$) (Table 1). Analysis of the average time the examinees took to engage in sports and other physical activities indicate that during the first calculation examinees spent less time with sport and other physical activities, in relation to the second calculation, 6.82±3.6 hrs and 7.24±3.8 hrs, accordingly.

Table.1 First (I) and Second (II) calculation of automated cycloplegic computer refractometry of the right and left eye

		Mean	N	SD	SEM	T	p
Pair 1	I calculation cycloplegic automated computer refractometry of the right eye (Dsph)	-1.33	100	0.611	0.06	6.39	0.0001
	II calculation cycloplegic automated computer refractometry of the right eye (Dsph)	-1.45	100	0.64	0.06		
Pair 2	II calculation cycloplegic automated computer refractometry of the left eye (Dsph)	-1.29	100	0.64	0.06	4.39	0.0001
	II calculation cycloplegic automated computer refractometry of the left eye (Dsph)	-1.40	100	0.69	0.07		

N- Total number of sample; SD- Standard deviation; SEM- standard arithmetic mean error; t- Student's t-test

Average values of total assessment of functional ability determined with Multistage Fitness Test between measurements were higher during the second measurement, 7.24±1.12, and 7.26±1.13, respectively but without statistically significant difference (Table 2).

Table 2. I and II calculation of appraising physical activity of examinees identified with multistage fitness test

	Mean	N	SD	SEM	T	p
I calculation assessment of functional ability	7.24	100	1.12	0.11	0.32	0.75
II calculation assessment of functional ability	7.26	100	1.13	0.11		

N, total number of samples; SD, standard deviation; SEM, standard arithmetic mean error; t, student's t-test

A meaningful correlation was documented only according to difference of cycloplegic automatic computer refractometry of the right and left eye of the first and second calculation, indicating that myopia increased with a decrease of visual acuity. Moreover, it was identified that in case of differences of cycloplegic automatic computer refractometry between the first and second calculation of the right and left eye, a significant correlation was recorded only according to evaluation of functional ability during the second calculation with a negative sign, showing that increase of examinees' functional ability impacts on reduces of differences of cycloplegic automatic computer refractometry of the first and second calculation, e.g. it does not cause the increase of shortsightdness (Table 3).

Table 3. Correlation between difference of the first(I) and second (II) calculation

		Difference I and II (Dsph) O.D.	**Difference I and II (Dsph) O.S.**	**I calculation assessment of functional ability**	**II calculation assessment of functional ability**	**Age**
Difference I and II V.O.D.	**Rho**	0.81^{*}	0.54^{*}	-0.15	0.13	-0.09
	P	0.00	0.00	0.13	0.19	0.39
Difference I and II V.O.S.	**Rho**	0.71^{*}	0.60^{*}	-0.16	0.09	-0.05
	P					

	0.00	0.00	0.11	0.37	0.61
Difference I and II (Dsph) O.D. **Rho** **P**		0.68* 0.00	-0.05 0.60	-0.26* 0.00	-0.03 0.76
Difference I and II (Dsph) O.S. **Rho** **P**			0.00 0.99	-0.26† 0.01	0.06 0.57

Correlation significant on the level p<0.01; † Correlation significant on the level p<0.05; Rho- Pearson's correlation, V.O.D.- distance visual acuity without correction of the right eye, V.O.S.- distance visual acuity without correction of the left eye, O.D.- automated computer cycloplegic refractometry right eye, O.S.- automated computer cycloplegic refractometry left eye.

Multivariate regression analysis of the impact on the difference of distance visual acuity outside adjustment of the right eye and left eye and the difference of cycloplegic automatic computer refractometry of both eyes showing that evaluation functional ability during the first and second calculation was a statistically meaningful impact on the reduce of difference of distance visual acuity and reduce of difference of cycloplegic automatic computer refractometry between two calculation (Table 4,5).

Table 4. Multivariate regression analysis of impact on the difference of distance visual acuity without correction of the right and left eye

Coefficient	Non-standardized		Standardized	t	P	95.0% confidence interval B	
	B	Std. error	Beta			Lower	Upper
(Constant) right eye	0.07	0.07		1.00	-4.95	-0.07	0.21
I calculation-assessment of functional ability	-0.05	0.01	-0.75	-4.95	0.00	-0.08	-0.03
II calculation-assessment of functional ability	-0.05	0.01	-0.66	-4.27	0.00	-0.7	-0.02
(Constant) left eye	0.02	0.07		0.31	0.76	-0.12	0.16
I calculation-assessment of functional ability	-0.04	0.01	-0.61	-3.95	0.00	0.06	-0.02
II calculation-assessment of functional ability	-0.04	0.01	-0.52	-3.25	0.00	-0.06	-0.01

* Dependent variable: I and II measurement difference of distance visual acuity outside adjustment of the right and left eye; B- results of regression analysis; Beta- Probability ratio; t- student's t-test

Table 5. Multivariable regression analysis of impact on the difference of cycloplegic automated computer refractometry of the right and left eye

Coefficient	Non-standardized		Standardized	t	P	95.0% confidence interval B	
	B	Std. error	Beta			Lower	Upper
(Constant) right eye	0.15	0.16		0.94	0.35	-0.17	0.47
I calculation-assessment of functional ability	-0.05	0.01	-0.83	-5.76	0.00	-0.20	-0.10
				-5.69	0.00	-0.20	-0.95
II calculation-assessment of functiaonl ability	-0.05	0.01	-0.66	0.31	0.75	-0.12	0.16
(Constant) left eye	0.02	0.07		-3.95	0.00	-0.06	-0.02
I calculation-assessment of functional ability	-0.04	0.01	-0.61	-3.25	0.00	-0.06	-0.01
II calculation-assessment of functional abilty	-0.04	0.01	-0.52	-3.25	0.00	-0.06	-0.01

* Dependent variable: I and II measurement difference of distance visual acuity without correction of the right and left eye; B- results of regression analysis; Beta- Probability ratio; t- student's t-test

DISCUSSION

With the advancement of decency, there has been an increasing number of persons diagnosed with shortsightdness[3, 13]. Allocation of shortsightdness is dispersing in distinct parts of the world. In the former Yugoslavia, according to Dorn, shortsightdness happened in 12% of dwellers[2]. The desire of this study was do drive the connection between physical activity and shortsightdness development. A meaningful correlation was documented only according to evaluation of functional ability during the second calculation with a negative sign, showing that an increase of physical activity had an impact on reduces of differences of values of cycloplegic automatic computer refractometry of both calculations. Multivariate regression examination and determination of impact on the dissimilarity of distance visual acuity outside adjustment of both eyes as well as the impact on difference of cycloplegic automatic computer refractometry showed that assessment of functional ability during the first and second calculation had a statistically meaningful impact on the reduction of distance visual acuity between calculations and on reduced difference of cycloplegic automatic computer refractometry.

This study contained greater female examinees in connection to male ones. However, this conclusion, considering the amount of samples cannot be applicable for a result that shortsightdness is most common in female students. Other studies entrenched that shortsightdness is most common in females than males. Richler and Bear in Newfoundland study also showed greater preponderance of shortsightdness in females than males[12], which was driven by Angle and Wissmann[13], as well as Goldschmidt[14]. Pärssinen and Lyyrain case of Finnish children driven that shortsightdness was most common with girls because boys spent most of time in sport activities[15], which was identified by Lu et al. in Chinese children and adolescent, since girls spent most of time in reading and doing homework than boys, who spent most of time in activities at open space[16]. The same was identified by French et al. in school children in Sydney[17] as well as You et al. in Chinese adolescent[18]. This study has concluded that in case of examinees with greater physical activity, that is, functional ability, there was a smaller difference of cycloplegic automatic computer refractometry between calculations, leading to the conclusion that greater physical activity did not originate shortsightdness development.

Based on multivariate regression analysis of impact on differences of distance visual acuity and cycloplegic automatic computer refractometry of both eyes, it was driven that physical activity did not originate the reduction of distance visual acuity, that is, increase of shortsightdness. Furthermore, this study has concluded that functional ability of examinees did not originate the increase of shortsightdness in student population. Rose et al. found lower preponderance of shortsightdness in Chinese children and preadult existing in Sydney in connection to Chinese children and preadult existing in Singapore, since children in Sydney spent several hours engaged in open physical activities, and children in Singapore go to school a bit earlier and thereby, spend less time playing outside[19]. Rose study was also confirmed in research by Guggenheim et al., who objectively measured functional ability and driven that less time was spent in sports and physical activity causing to increase of the shortsightdness level[7]. Mutti et al. determined in two studies a "protective" role of external activity on myopia progression, that is, in case of individuals who were engaged in sport and other external physical activities, shortsightdness did not increase[20]. The same was confirmed by Jones-Jordan et al. that persons diagnosed with shortsightdness spent less time engaged in sports and physical activities in childhood prior and following the occurrence of shortsightdness in relation to emmetropes[4]. Donovan et al. determined that shortsightdness progression is slower during summer than winter, because people spend more time outside during the summer and they are more engaged in sport activities[21]. Increase of physical activity on open space and engaging in sport can have potential impact on prevention of myopia increase. A further study is necessary in order to completely define the relation of physical activity as an external factor and shortsightdness, and possibility and practical application of new findings in everyday human life. In conclusion, physical activity (physical competence), identified with the Multistage Fitness Test, did not cause the increase of myopia in students. This study, which was done among the first ones on this region, opened a potential for further and broader study on the impact of physical activity on shortsightdness.

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