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ANALYSIS OF THE EFFECTIVENESS OF MYOPIA CORRECTION WITH CONTACT LENSES IN CHILDREN

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Successful social rehabilitation requires early application of contact correction of congenital myopia and astigmatism in children and adolescents. In contrast to the use of glasses, the correction of myopia using contact lenses ensures the stability of the correction and the absence of periods of blurring of the retinal image. The aim of the study was to determine the effectiveness of using contact lenses and their effect on improving uncorrected and maximally corrected visual acuity in school-age children with myopia and myopic astigmatism. The study included 84 children (168 eyes) aged 6-16 years with myopic refraction and astigmatism who used soft silicone-hydrogel aspheric contact lenses for the correction of ametropia. The observation period is three years. All patients underwent a comprehensive examination at the beginning and at the end of the study, which included determination of visual acuity, objective and subjective clinical refraction, axial length of the eye, thickness and diameter of the cornea, keratometry and phorometric data (accommodation, vergence, separated areas and oculomotor apparatus and their interaction). After three years of observation and constant use of contact lenses for the correction of myopia and myopic astigmatism in school-aged children, statistically significant results were recorded, namely: an increase in uncorrected visual acuity by 47% (t=5.2; p<0.01), corrected acuity vision by 8% (t=9.3; p<0.01), the spheroequivalent by 17% (t=3.7; p<0.01), anteroposterior segment of the eye by 4% (t=7,1; p<0.01), amplitude of accommodation by 27% (t=14.6; p<0.01), negative part of relative accommodation by 17% (t=7.3; p<0.01), positive part of relative accommodation by 32% (t=7.1; p<0.01), flexibility of accommodation by 35% (t=14.2; p<0.01), the ratio of accommodation convergence to accommodation by 19% (t=3.4, p<0.01), stereovision acuity by 56% (t=4.1; p<0.01), as well as a decrease in keratometry index in the strong meridian by 2% (t=5.2; p<0.01), delays in accommodative responses by 33% (t=14.2; p<0.01), distance phoria by 16% (t=10.1; p<0.01), near phoria by 16% (t=11.3, p<0.01). The results of the study indicate that the use of contact lenses by school-aged children with myopia and myopic astigmatism can increase uncorrected and maximally corrected visual acuity. The progression of myopia is indicated by an increase in the spheroequivalent and anteroposterior axis (PZO) of the eye, but the use of soft contact lenses (SCL) leads to changes in the front surface of the cornea: an increase in thickness in the central zone and its flattening. In addition, improvement in accommodation, vergence, different departments of the oculomotor apparatus and their interaction was observed in the main group. The obtained results indicate a slowing down of the progression of myopia.

Key words: *myopia, contact correction, APA: anteroposterior axis, NRA: negative relative accommodation, PRA: positive relative accommodation.*

Connection of the publication with the planned scientific research.

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Introduction.

Refraction anomalies account for 33–75% of the structure of detected ophthalmic pathology in children and adolescents, and myopia accounts for 80% of all refraction anomalies. Myopia is the leading cause of visual impairment in children in all developed countries in Europe and America. According to the literature, myopia occurs in 33% of the young population of Western countries [1, 2, 3]. Myopic refraction occurs in 4–6% of children under 1 year, and in preschool-age, the incidence of myopia does not exceed 2–3%. Weak myopia is more common in preschool children. Myopia, which is found in children before the time of entering school, is more often congenital [4].

To stabilize progressive myopia, proper optical correction is important. The means of optical correction for myopia include glasses, progressive correction, as well as a correction with soft (spherical and bifocal) and orthokeratological lenses. Lack of full-fledged vision correction during the development of the visual system leads to severe functional impairment of vision.

Nowadays, spectacles are still the most common way to correct myopia, but they have some disadvantages: cosmetic, limited field of view, effect on the size of the retinal image, distortion of size and contours of objects, prismatic effect, limitations when correcting anisometropia, and changes in-depth perception [5, 6].

Contact lenses are free of the above disadvantages and in ophthalmopediatrics have a few undeniable advantages over spectacles. Primarily the cosmetic effect, no restrictions on physical activity, and no effect on the size of the retinal image [7]. In the conservative treatment of high refractive errors, congenital myopia, myopic anisometropia, there is no alternative to contact lenses, which not only improve the quality of vision but also contribute to the proper development of the visual analyzer in children [5].

The advantages of contact lenses also include sustained correction of ametropia, the absence of periods with a blurred retinal image, which is observed with the use of glasses. Soft silicone hydrogel contact lenses provide adequate oxygen supply to the cornea, which reduces hypoxic complications, is more comfortable than hard contact lenses, and allows children to play sports. Early use of contact correction of congenital myopia and astigmatism in children and adolescents contributes to social rehabilitation [8].

The aim of the study.

The study was targeted to determine, through long-term follow-up, the extent to which contact lens correction improves uncorrected and maximally corrected visual acuity in school-age children with myopia and myopic astigmatism.

Object and research methods.

We followed up for three years 84 children (168 eyes) aged 6–16 years with myopic manifest refraction and astigmatism, who used soft silicone hydrogel aspherical contact lenses to correct ametropia. In the early and late follow-up, these patients were examined for visual acuity, objective and subjective clinical refraction, axial eye length, corneal thickness and diameter, keratometry, and phorometric data (accommodation, vergence, disparate areas, and oculomotor apparatus and their interaction).

The mean values of the variable (M) and standard deviation (±σ) were calculated to represent quantitative data. Student's *t*-test was used to determine the statistical significance of differences between the mean values in the two independent groups. The null hypothesis of no effect was excluded, and the differences between the indices were considered statistically significant at the $p<0.05$ significance level.

Research results and their discussion.

Initial examination. **84 patients (168 eyes)**. Uncorrected visual acuity 0.01–0.06 was in 32 eyes (19.05%), 0.08–0.2 in 60 eyes (35.7%), 0.3–0.6 was in 76 eyes (45.2%) and the mean was 0.19±0.11 (range 0.01 to 0.6). The maximum visual acuity with correction was 0.92±0.08. The spheroequivalent was –4.2±1.6 diopters (D), the mean keratometry was 44.02±1.2 D in the weak and 44.9±1.2 D in the strong meridian. The central corneal thickness was 539.9±29.95 μm. The mean of APA was 24.65±1.0 mm, and the horizontal corneal white-to-white (WTW) diameter was 11.8±0.3. The mean of accommodation amplitude was 9.54±1.23 D, the negative relative accommodation (NRA) was +1.26±0.44 D, and positive relative accommodation (PRA) was –0.92±0.14 D, with the accommodative lag found as +1.86±0.28 D, the mean of monocular accommodation flexibility was 7.51±0.32 cycles/min. The distance phoria averaged exo 5.29±1.78 prism diopters, the near phoria was exo 9.25±0.35 prism diopters. The ratio of accommodation convergence to accommodation was 2.3±0.36 prism diopters. The sharpness of stereoscopic vision averaged 153.63±7.07 arc seconds.

1-month follow-up. **84 patients (168 eyes)**. Uncorrected visual acuity 0.01–0.06 was in 32 eyes (19.05%), 0.08–0.2 was in 60 eyes (35.7%), 0.3–0.6 was in 76 eyes (45.2%) and the mean was 0.19±0.14 (range 0.01 to 0.6). The maximum visual acuity with correction was 0.94±0.06. The spheroequivalent was –4.1±1.4 D, the mean keratometry was 44.06±1.2 D in the weak and 44.8±1.2 D in the strong meridian. The central corneal thickness was 537.9±26.46 μm. The mean of APA was 24.59±1.0 mm, and the horizontal corneal WTW diameter was 11.7±0.2. The mean of accommodation amplitude was found to be 9.63±1.28 D, the NRA was +1.29±0.46 D, the PRA was –0.96±0.16 D, the accommodation lag was +1.83±0.24 D, and the mean of monocular accommodation flexibility was 7.6±0.34 cycles/min. The distance phoria averaged exo 5.27±1.58 prism diopters with the near phoria being exo 9.21±0.33 prism diopters. The ratio of accommodation convergence to accommodation was 2.4±0.29 prism diopters. The sharpness of stereoscopic vision averaged 152.44±6.12 arc seconds.

6-month follow-up. **84 patients (168 eyes).** Uncorrected visual acuity 0.01–0.06 was in 32 eyes (19.05%), 0.08–0.2 was in 60 eyes (35.7%), 0.3-0.6 was on 76 eyes (45.2%) and averaged 0.18±0.16 (from 0.01 to 0.6). The maximum visual acuity with correction was 0.95±0.06. The spheroequivalent was –4.2±1.5 D, the mean of keratometry was 44.08±1.3 D in the weak and 44.7±1.2 D in the strong meridian. The central corneal thickness was 538.6±34.5 μm. The mean of APA was 24.62±1.2 mm, and the horizontal corneal WTW diameter was 11.7±0.4. The mean of accommodation amplitude was found to be 9.66±1.24 D, the NRA was +1.31±0.48 D, the PRA was –0.98±0.17 D, the accommodation lag was +1.80±0.22 D, and the mean of monocularly accommodation flexibility was 7.81±0.28 cycles/min. The distance phoria averaged exo 5.20±1.62 prism diopters with the near phoria being exo 9.12±0.41 prism diopters. The ratio of accommodation convergence to accommodation was 2.7±0.42 prism diopters. The sharpness of stereoscopic vision was averaged 149.78±6.08 arc seconds.

1-year follow-up. **84 patients (168 eyes).** Uncorrected visual acuity 0.01–0.06 was in 32 eyes (19.05%), 0.08–0.2 was in 60 eyes (35.7%), 0.3–0.6 was in 76 eyes (45.2%) and the mean was 0.18±0.16 (range 0.01 to 0.6). The maximum visual acuity with correction was 0.95±0.02. The spheroequivalent was –4.3±1.5 D, the mean keratometry was 44.02±1.3 D in the weak and 44.5±1.3 D in the strong meridian. The central corneal thickness was 539.7±29.5 μm. The mean of APA was 24.64±1.3 mm, and the horizontal corneal WTW diameter was 11.8±0.6. The mean of accommodation amplitude was found to be 9.97±1.34 D, the NRA was +1.36±0.46 D, the PRA was –1.06±0.18 D, the accommodation lag was +1.78±0.24 D, and the mean of monocular accommodation flexibility was 7.94±0.28 cycles/min. The distance phoria averaged exo 5.14±1.45 prism diopters with the near phoria being exo 8.98±0.27 prism diopters. The ratio of accommodation convergence to accommodation was 2.87±0.31 prism diopters. The sharpness of stereoscopic vision averaged 139.89±6.17 arc seconds.

1.5-year follow-up. **84 patients (168 eyes).** Uncorrected visual acuity 0.01–0.06 was in 31 eyes (18.45%), 0.08–0.2 was in 61 eyes (36.3%), 0.3–0.6 was in 76 eyes (45.2%) and the mean was 0.21±0.18 (range 0.01 to 0.6). The maximum visual acuity with correction was

0.95±0.06. The spheroequivalent was –4.6±1.6 D, the mean keratometry was 44.02±1.2 D in the weak and 44.5±1.4 D in the strong meridian. The central corneal thickness was 537.6±34.6 µm. The mean of APA was 24.9±0.9 mm, and the horizontal corneal WTW diameter was 11.7±0.5. The mean of accommodation amplitude was found to be 10.02±1.45 D, the NRA was +1.35±0.45 D, the PRA was –1.05±0.16 D, the accommodation lag was +1.77±0.31 D, and the mean of monocular accommodation flexibility was 7.95±0.21 cycles/min. The distance phoria averaged exo 5.16±1.38 prism diopters with the near phoria being exo 8.97±0.22 prism diopters. The ratio of accommodation convergence to accommodation was 2.86±0.32 prism diopters. The sharpness of stereoscopic vision averaged 137.71±4.6 arc seconds.

2-year follow-up. **80 patients (160 eyes).** Uncorrected visual acuity 0.01–0.06 was in 31 eyes (19.37%), 0.08–0.2 was in 61 eyes (38.13%), 0.3–0.6 was in 68 eyes (42.5%) and the mean was 0.24±0.16 (range 0.01 to 0.6). The maximum visual acuity with correction was 0.97±0.04. The spheroequivalent was –4.8±1.7 D, the mean keratometry was 44.01±1.2 D in the weak and 44.4±1.6 D in the strong meridian. The central corneal thickness was 537.9±34.8 µm. The mean of APA was 25.1±0.9 mm, and the horizontal corneal WTW diameter was 11.7±0.6. The mean of accommodation amplitude was found to be 10.02±1.31 D, the NRA was +1.38±0.46 D, the PRA was –1.08±0.14 D, the accommodation lag was +1.80±0.24 D, and the mean of monocular accommodation flexibility was 8.01±0.36 cycles/min. The distance phoria averaged exo 5.01±1.72 prism diopters with the near phoria being exo 8.25±0.31 prism diopters. The ratio of accommodation convergence to accommodation was 2.6±0.34 prism diopters. The sharpness of stereoscopic vision averaged 121.54±7.14 arc seconds.

2.5-year follow-up. **80 patients (160 eyes).** Uncorrected visual acuity 0.01–0.06 was in 31 eyes (19.37%), 0.08–0.2 was in 61 eyes (38.13%), 0.3–0.6 was in 68 eyes (42.5%) and the mean was 0.25±0.16 (range 0.01 to 0.6). The maximum visual acuity with correction was 0.98±0.04. The spheroequivalent was –4.8±1.6 D, the mean keratometry was 43.98±1.8 D in the weak and 44.2±1.5 D in the strong meridian. The central corneal thickness was 542.9±41.1 µm. The mean of APA was 25.62±1.08 mm, and the horizontal corneal WTW diameter was 11.7±0.6. The mean of accommodation amplitude was found to be 11.4±1.38 D, the NRA was +1.39±0.44 D, the PRA was –1.09±0.19 D, the accommodation lag was +1.84±0.26 D, and the mean of monocular accommodation flexibility was 8.04±0.28 cycles/min. The distance phoria averaged exo 5.03±1.65 prism diopters with the near phoria being exo 8.11±0.32 prism diopters. The ratio of accommodation convergence to accommodation was 2.52±0.37 prism diopters. The sharpness of stereoscopic vision averaged 113.84±6.24 arc seconds.

3-year follow-up. **78 patients (156 eyes).** Uncorrected visual acuity 0.01–0.06 was in 29 eyes (18.58%), 0.08–0.2 was in 60 eyes (38.46%), 0.3–0.6 was in 67 eyes (42.94%) and the mean was 0.28±0.2 (range 0.01 to 0.6). The maximum visual acuity with correction was 0.99±0.01. The spheroequivalent was –4.92±1.7 D, the mean keratometry was 43.95±1.9 D in the weak and 44.06±1.8 D in the strong meridian. The central corneal thickness was 544.3±44.1 µm. The mean of APA was 25.64±1.12 mm, and the horizontal corneal WTW diameter was 11.8±0.5. The mean of accommodation amplitude was found to be 12.1±1.22 D, the NRA was +1.48±0.46 D, the PRA was –1.21±0.16 D, the accommodation lag was +1.4±0.14 D, and the mean of monocular accommodation flexibility was 10.12±0.17 cycles/min. The distance phoria averaged exo 4.58±0.98 prism diopters with the near phoria being exo 7.98±0.31 prism diopters. The ratio of accommodation convergence to accommodation was 2.74±0.26 prism diopters. The sharpness of stereoscopic vision averaged 98.76±4.87 arc seconds.

The use of contact correction for the school-age children allowed attaining a statistically significant increase in uncorrected visual acuity by 11% after 1.5 years of follow-up ($t=2.0$; $p<0.05$), after 2 years by 26% = 3.0; $p<0.01$), after 2.5 years by 32% ($t=3.6$; $p<0.01$), after 3 years by 47% ($t=5.2$; $p<0.01$).

There is also a statistically significant increase in corrected visual acuity by 2% after 1 month of the follow-up ($t=2.3$; $p<0.05$), after 6 months, 1 year and 1.5 years by 3% ($t_{6mth}=3.5$; $t_{1yr}=3.4$; $t_{1.5yr}=3.5$; $p<0.01$), after 2 years by 5% ($t=6.0$; $p<0.01$), after 2.5 years by 7% ($t=7.3$; $p<0.01$), after 3 years by 8% ($t=9.3$; $p<0.01$).

Notwithstanding the use of contact correction, there was a statistically significant increase in the spheroequivalent index by 10% after 1.5 years of the follow-up ($t = 2.0$; $p < 0.05$), after 2 and 2.5 years by 14% ($t_{2yr}=3.0$; $t_{2.5yr}=3.1$; $p<0.01$), after 3 years by 17% ($t=3.7$; $p<0.01$).

The use of contact correction in school-age children allowed a statistically significant decrease in the keratometry index in the strong meridian by 1% observed after 1, 1.5, and 2 years of the follow-up ($t_{1yr\ follow\text{-}up}=2.5$; $t_{1.5yr\ follow\text{-}up}= 2.5$, $p<0.05$; $t_{2yr\ follow\text{-}up}=3.1$, $p<0.01$) and by 2% after 2.5 and 3 years of the follow-up ($t_{2.5yr\ follow\text{-}up}=4.3$; $t_{3yr\ follow\text{-}up}=5.2$, $p<0.01$).

Using contact correction for school-age children, the follow-up after 2.5 and 3 years exposes a tendency in increasing the thickness of the cornea in the central area, but the data is not statistically significant ($t_{2.5\ yr}=0.8$; $t_{3\ yr}=1.1$; $p>0.05$).

Despite the use of contact correction in school-age children, there is a statistically significant increase in the length of the anteroposterior segment of the eye. After two years, the length of the eye increases statistically significantly by 2% ($t_{2yr}=3.3$; $p<0.01$), after 2.5 and 3 years by 4% ($t=7.1$; $p<0.01$).

When using contact correction in school-age children, there is a statistically significant increase of accommodation amplitude after 1 and 1.5 years by 5% ($t_{1yr}=2.4$, $p<0.05$; $t_{1.5yr}=2.7$, $p<0.01$), after 2 years by 7% ($t=2.8$, $p<0.01$), after 2.5 years by 19% ($t=9.9$, $p<0.01$), after 3 years by 27% ($t=14.6$, $p<0.01$), the negative part of the relative accommodation after 1 and 1.5 years increases by 8% and 7% respectively ($t_{1yr}=2.5$, $p<0.05$; $t_{1.5yr}=2.4$, $p<0.05$), after 2 and 2.5 years by 10% ($t_{2yr}=3.4$, $p<0.01$; $t_{2.5yr}=3.6$, $p<0.01$), after 3 years by 17% ($t=7.3$, $p<0.01$), and the positive part of the relative accommodation after 1 year by 15% ($t=2.7$, $p<0.01$), after 1,5 years by 14% ($t=2.6$, $p<0.01$), after 2 years by 17% ($t=3.4$, $p<0.01$), after 2.5 years by 19% ($t=3.6$, $p<0.01$), after 3 years by 32% ($t=7.1$, $p<0.01$), accommodation flexibility after 1 and 1.5 years by 6% ($t_{1yr}=2.5$, $p<0.05$; $t_{1.5yr}=2.6$, p<0.01), after 2 and 2.5 years by 7% (t_{2yr}=2.9, p<0.01; $t_{2.5yr}$=3, 1, p<0.01), after 3 years by 35% (t=14.2, p<0.01).

There was also a statistically significant decrease in accommodation response lag after 3 years by 33% (t=14.2, p<0.01).

Under contact correction with lenses in school-age children, phoria at distance decreases statistically significantly after 2 years by 6% (t=3.1, p<0.01), after 2.5 years by 5% (t=2.9, p<0.01), after 3 years by 16% (t=10.1, p<0.01), phoria at near decreases after 2 years by 12% (t=5.2, p<0.01), after 2.5 years by 14% (t=6.4, p<0.01), and after 3 years by 16% (t=11.3, p<0.01).

There is also a statistically significant increase in the ratio of accommodation convergence to accommodation after 6 months by 17% (t=3.4, p<0.01), after 1 year by 25% (t=5.4, p<0.01), after 1.5 years by 24% (t=5.3, p<0.01), after 2 years by 13% (t=3.1, p<0.01), and after 3 years by 19% (t=3.4, p<0.01).

When applying correction with contact lenses for school-age children, there is a statistically significant increase in stereo visual acuity after two years of the follow-up by 26% (t=2.3; p<0.05), after 2.5 years by 35% (t=2.9; p<0.01), after 3 years by 56% (t=4.1; p<0.01).

The leading role in the set of measures to control myopia is given to the selection of full-fledged correction, which should create conditions for the development of the visual analyzer and ensure maximum visual acuity [9]. Contact lenses have a variety of advantages in this case, as they form a single optical system with the eye, transmit the image size without the distortion, and prismatic effect typical for spectacle lenses, especially with high refractive powers. Medical publications show that when correcting myopia above 6,00 D the average visual acuity is 1.6 times higher with contact lenses than with spectacles. It is also believed that contact lenses improve accommodation performance and some optical designs can compensate for insufficient accommodation [10].

Our three-year studies have established that the use of contact lens correction in school-aged children with myopia and myopic astigmatism can increase uncorrected and maximum corrected visual acuity. An increase of the spheroequivalent index and increase of the APA length of the eye is the evidence of progressing myopia, but the use of soft contact lenses leads to changes of the anterior corneal surface: increase of the thickness in the central zone, and its flattening. There are also observed improvements of accommodation, vergence, disparate areas of the oculomotor apparatus, and their interaction. The results obtained are indicative of the slowdown of myopia progression.

Conclusions.

The three-year follow-up of contact correction in school-aged children with myopia and myopic astigmatism found the statistically significant increases in uncorrected visual acuity by 47% (t=5.2; p<0.01), corrected visual acuity by 8% (t=9.3; p<0.01), spheroequivalent index by 17% (t=3.7; p<0.01), the anteroposterior segment of the eye by 4% (t=7.1; p<0.01), the amplitude of accommodation by 27% (t=14.6, p<0.01), the negative part of the relative accommodation by 17% (t=7.3, p<0.01), the positive part of relative accommodation by 32% (t=7, 1, p<0.01), the accommodation flexibility by 35% (t=14.2, p<0.01), the accommodation convergence to accommodation ratio by 19% (t=3.4, p<0.01), and stereo acuity by 56% (t=4.1 p<0,01). We also observed a decrease of keratometry in the strong meridian by 2% (t=5.2; p<0.01), the decrease of accommodative lag by 33% (t=14.2, p<0.01), the decrease in phoria at distance by 16% (t=10.1, p<0.01), and the decrease in phoria at near by 16% (t=11.3, p<0.01).

Prospects for further research.

The analysis of the literature shows that the treatment of school-aged children myopia and myopic astigmatism is an urgent task of modern ophthalmology, and this explains the desire of ophthalmologists to improve the known and develop new methods of contact correction of this disease, especially in the subclinical stages. Therefore, it seems relevant and timely to study the possibilities of using increase uncorrected and maximum corrected visual acuity as means of the treatment of patients with school-aged children myopia.

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АНАЛІЗ ЕФЕКТИВНОСТІ ЗАСТОСУВАННЯ КОНТАКТНОЇ КОРЕКЦІЇ У ДІТЕЙ З МІОПІЄЮ

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Резюме. *Вступ.* Раннє застосування контактної корекції вродженої короткозорості та астигматизму у дітей та підлітків сприяє їх соціальній реабілітації. Окуляри та контактна корекція добре переноситься дітьми при аметропії слабкою та середнього ступеню. Корекція міопії контактними лінзами забезпечує стійкість корекції та відсутність періодів розмитості зображення сітківки, які виникають при використанні окулярів. При аметропії високого ступеню поліпшення монокулярної гостроти зору з контактною лінзою у порівнянні з корекцією окулярами вище в 3,8 разів. *Мета* дослідження полягала в тому, щоб шляхом тривалого спостереження визначити, наскільки корекція контактними лінзами покращує некориговану та максимально скориговану гостроту зору у дітей шкільного віку з короткозорістю та міопічним астигматизмом. *Матеріал і методи.* Протягом трьох років ми спостерігали за 84 дітьми (168 очей) віком 6–16 років із короткозорою рефракцією та астигматизмом, які використовували м'які силікон-гідрогелеві асферичні контактні лінзи для корекції аметропії. Під час раннього та пізнього спостереження у цих пацієнтів перевіряли гостроту зору, об'єктивну та суб'єктивну клінічну рефракцію, осьову довжину ока, товщину та діаметр рогівки, кератометрію та форометричні дані (акомодація, вергенція, розрізнені ділянки та окоруховий апарат та їх взаємодія). Для подання кількісних показників розраховувалося середнє значення змінної (M), стандартне відхилення (±σ). Для визначення статистичної значущості відмінностей середніх значень в двох незалежних групах використовували t-критерій Стьюдента. Нульову гіпотезу про відсутність ефекту відкидали і відмінності між показниками вважали статистично значущими при рівні значущості p<0,05. Строк спостереження – 3 роки. *Результати.* Під час тривалого моніторингу корекції міопії та міопічного астигматизму контактними лінзами у дітей шкільного віку за три роки спостереження зафіксовано статистично значущі результати, а саме: підвищення некоригованої гостроти зору на 47% (t=5,2; p<0,01), скорегована гострота зору на 8% (t=9,3; p<0,01), сфероеквівалент на 17% (t=3,7; p<0,01), передньо-задній відрізок ока на 4% (t=7,1; p<0,01), амплітуда акомодації на 27% (t=14,6; p<0,01), негативна частка відносної акомодації на 17% (t=7,3; p<0,01), позитивна частка відносної акомодації на 32% (t =7,1; p<0,01), гнучкість акомодації на 35% (t=14,2; p<0,01), відношення конвергенції акомодації до акомодації на 19% (t=3,4, p<0,01), гострота стереозору на 56% (t=4,1; p<0,01), а також зниження індексу кератометрії в сильному меридіані на 2% (t=5,2; p<0,01), затримки акомодаційних реакцій на 33% (t=14,2; p<0,01), дальню форію на 16% (t=10,1; p<0,01), ближню форію на 16% (t=11,3, p<0,01). Проведені нами дослідження упродовж 3-х років встановили, що використання контактної корекції у дітей шкільного віку з міопією та міопічним астигматизмом дозволяє підвищити некориговану та максимально кориговану гостроту зору. Підвищення показника сфероеквіваленту та збільшення довжини ПЗВ ока свідчить про прогрессування міопії, однак використання МКЛ призводить до змін передньої поверхні рогівки: збільшенню товщини у центральної зоні, та її сплощенню. Також реєструється поліпшення показників акомодації, вергенції, диспаратних ділянок окорухового апарату та їх взаємодії. Отримані результати сівдчать про уповільнення прогрессування міопії. *Висновки.* Дослідження показало, що використання контактних лінз дітьми шкільного віку з короткозорістю та міопічним астигматизмом може підвищити некориговану та максимально скориговану гостроту зору. Збільшення сфероеквівалентної та передньозадньої вісі (ПЗВ) ока свідчить про прогресування міопії, але використання м'яких контактних лінз (МКЛ) призводить до змін передньої поверхні рогівки: збільшення товщини в центральній зоні та її сплющування. Спостерігалося також покращення акомодації, вергенції, розрізнених відділів окорухового апарату та їх взаємодії. Отримані результати свідчать про уповільнення прогресування міопії.

Ключові слова: короткозорість, контактна корекція, ПЗВ: передньозадня вісь, НВА: негативна відносна акомодація, ПВА: позитивна відносна акомодація.

ANALYSIS OF THE EFFECTIVENESS OF MYOPIA CORRECTION WITH CONTACT LENSES IN CHILDREN

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Abstract. *Introduction and purpose.* Early use of contact correction for congenital myopia and astigmatism in children and adolescents contributes to their social rehabilitation. Glasses and contact correction are well tolerated by children with mild to moderate ametropia. The myopia correction with contact lenses provides sustainability of correction and absence of periods of blurred retinal images, which are experienced with the use of glasses. At ametropia of high degree of improvement of monocular visual acuity with a contact lens in comparison with correction by glasses is 3.8 times higher. *The purpose* of the study was to determine, through long-term follow-up, the extent to which contact lens correction improves uncorrected and maximally corrected visual acuity in school-age children with myopia and myopic astigmatism. *Material and methods.* We followed up for three years 84 children (168 eyes) aged 6–16 years with myopic manifest refraction and astigmatism, who used soft silicone hydrogel aspherical contact lenses to correct ametropia. In the early and late follow-up, these patients were examined for visual acuity, objective and subjective clinical refraction, axial eye length, corneal thickness and diameter, keratometry, and phorometric data (accommodation, vergence, disparate areas, and oculomotor apparatus and their interaction). The mean values of the variable (M) and standard deviation (±σ) were calculated to represent quantitative data. Student's *t*-test was used to determine the statistical significance of differences between the mean values in the two independent groups. The null hypothesis of no effect was excluded, and the differences between the indices were considered statistically significant at the p<0.05 significance level. The observation period is 3 years. *Results.* In course of long-term monitoring of myopia and myopic astigmatism correction with contact lenses in school-age children, the statistically significant results were recorded after three years of observation, namely: an increase in uncorrected visual acuity by 47% (t=5.2; p<0.01), corrected acuity vision by 8% (t=9.3; p<0.01), the spheroequivalent by 17% (t=3.7; p<0.01), anteroposterior segment of the eye by 4% (t=7,1; p<0.01), amplitude of accommodation by 27% (t=14.6; p<0.01), negative part of relative accommodation by 17% (t=7.3; p<0.01), positive part of relative accommodation by 32% (t=7.1; p<0.01), flexibility of accommodation by 35% (t=14.2; p<0.01), the ratio of accommodation convergence to accommodation by 19% (t=3.4, p<0.01), stereovision acuity by 56% (t=4.1; p<0.01), as well as a decrease in keratometry index in the strong meridian by 2% (t=5.2; p<0.01), delays in accommodative responses by 33% (t=14.2; p <0.01), distance phoria by 16% (t=10.1; p<0.01), near phoria by 16% (t=11.3, p<0.01). Our three-year studies have established that the use of contact lens correction in school-aged children with myopia and myopic astigmatism can increase uncorrected and maximum corrected visual acuity. An increase of the sphero-equivalent index and increase of the APA length of the eye is the evidence of progressing myopia, but the use of soft contact lenses leads to changes of the anterior corneal surface: increase of the thickness in the central zone, and its flattening. There are also observed improvements of accommodation, vergence, disparate areas of the oculomotor apparatus, and their interaction. The results obtained are indicative of the slowdown of myopia progression. *Conclusions.* The study has shown that the use of contact lenses by school-aged children with myopia and myopic astigmatism can increase uncorrected and maximum corrected visual acuity. The increase of the spheroequivalent and anteroposterior axis (APA) of the eye indicates progression of myopia, but the use of soft contact lenses (SCL) leads to changes of the anterior corneal surface: an increase of the thickness in the central zone, and its flattening. Improvement of accommodation, vergence, disparate parts of the oculomotor apparatus, and their interaction was also observed. The results obtained indicate deceleration of myopia progression.

Key words: myopia, contact correction, APA: anteroposterior axis, NRA: negative relative accommodation, PRA: positive relative accommodation.

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