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Influence of orthokeratology lenses on the state of accommodative function in children with myopia

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Key words: Ocular Accommodation, Myopia, Lenses, Children.

Aim. It was showed that optimal optical correction have positive effect on the accommodative apparatus of the myopic eye. Absolute and relative accommodation reserves, the nearest point of clear vision in 50 patients (100 eyes) with mild myopia were studied in order to assess the state of the accommodative function of the eyes. **Methods and results.** All patients underwent refractive therapy with orthokeratology lenses Paragon CRT during the year. It was established that refractive lenses use for orthokeratology therapy in patients with myopia increases the accommodation reserves by 3,8 times and relative accommodation reserve by 2,8 times, the nearest point of clear vision – by 2,4 cm. **Conclusion.** This indicates the positive influence on accommodative opportunities of the myopic eyes.

Вплив ортокератологічних лінз на стан акомодативної функції у дітей із короткозорістю

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Оптимальна оптична корекція – один із засобів, що позитивно впливає на стан акомодативного апарату міопічного ока. З метою оцінки стану акомодативної функції ока вивчили резерви абсолютної акомодатії, запас відносної акомодатії і положення найближчої точки ясного зору в 50 пацієнтів (100 очей) із міопією слабкого ступеня, які отримують курс терапії рефракції ортокератологічними лінзами Paragon CRT протягом року. Встановили, що застосування ортокератологічних лінз у пацієнтів із міопією призводить до підвищення резервів акомодатії в 3,8 раза, збільшення запасу відносної акомодатії у 2,8 раза, найближчої точки ясного зору – на 2,4 см. Це свідчить про позитивний вплив на акомодативні можливості міопічного ока і є засобом профілактики прогресування міопії.

Ключові слова: акомодатія, короткозорість, лінзи, діти.

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Влияние ортокератологических линз на состояние аккомодационной функции у детей с близорукостью

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Одним из средств, положительно воздействующих на состояние аккомодационного аппарата миопического глаза, является оптимальная оптическая коррекция. С целью оценки состояния аккомодационной функции глаза изучены резервы абсолютной аккомодации, запас относительной аккомодации и положение ближайшей точки ясного зрения у 50 пациентов (100 глаз) с миопией слабой степени, проходящих курс рефракционной терапии ортокератологическими линзами Paragon CRT в течение года. Установлено, что применение рефракционной терапии ортокератологическими линзами у пациентов с миопией приводит к повышению резервов аккомодации в 3,8 раза, увеличению запаса относительной аккомодации в 2,8 раза, ближайшей точки ясного зрения – на 2,4 см. Это свидетельствует о положительном влиянии на аккомодационные возможности миопического глаза и является средством профилактики прогрессирования миопии.

Ключевые слова: аккомодация, миопия, линзы, дети.

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Study of the etiopathogenetical mechanisms of the myopia development shows that violation of the accommodative apparatus of eye is one of the leading factors [1]. Numerous observations in schoolchildren confirm existence of a close interrelation between weakened accommodative function and the development of myopia [1,2]. One of the means that allows to influence positively the accommodation apparatus of myopic eyes is optimal optical correction. In recent years method of correction of myopia with orthokeratology lenses (refractive therapy) has been widely used. In the literature the question about stabilization effect of refractive therapy for course of myopic refractogenesis in children is actively discussed [3,4]. In this connection study of the state of the functions of myopic eyes visual analyzer under the influence of orthokeratology correction is actual.

The aim of research – to evaluate the condition of accommodative function of the eyes in patients with orthokeratology myopia correction.

Materials and methods

To evaluate the state of accommodative function of the eye we analyzed data of 50 patients with mild myopia (100 eyes). All of them underwent course of refractive therapy with orthokeratology lenses Paragon CRT during the year and were included into the main group of supervision. Control group included 40 children (80 eyes) with emmetropia without ophthalmic pathology. Groups were representative in age, it ranged from 7 to 12 years. Besides the standard ophthalmologic examination, the performance of accommodative muscle both close and far distance namely reserves of absolute accommodation (RAA), relative accommodation (SRA), as well as the position of the nearest point of clear vision (PNPCV) were determined in all patients.

Data processing was performed using «Statistica for Windows 6.0» program. Differences between parameters were considered significant at $p < 0,05$. To evaluate differences we used Student's t-test. In the absence of a normal distribution of the variables in the study sample we used the nonparametric Mann-Whitney test.

**Results and discussion**

Results of the study of the state of accommodative function of the eye are shown in *table 1*.

Table 1

Dynamics of parameters of accommodative function in patients of the main and control group

Monitoring groups	Period of observation	Index		
		RAA, dpt	SRA, dpt	PNPCV, cm
Main group (n=100)	Before correction	1,4±0,08*◇	1,52±0,06*◇	5,7±0,21*◇
	1-3 months of observation	4,2±0,12*◇	2,75±0,06*◇	7,2±0,19*◇
	6 months of observation	5,6±0,13*	3,85±0,07*	7,72±0,2*
	12 months of observation	5,8±0,12*	3,82±0,07*	8,12±0,21*
Control group (n=80)	At the time of examination	6,8±0,11	4,26±0,08	9,38±0,23

NB: * p – statistically significant difference between the indices in the main group, p<0,05; ◇ p – statistically significant difference between the indices in the main and control groups, p<0,05.

As can be seen from the table, accommodative function is characterized by the reduction of all parameters in patients of main group with myopic refraction, relative to the control group of children with emmetropic refraction. Thus, RAA were out in 27 eyes, and in the remaining patients ranged from 0,5 dpt to 3,0 dpt and averaged $1,4 \pm 0,08$ dpt, that was 4,8 times lower than in the control group. On the background of low data of RAA indicators of SRA are marked and authentically small. This index ranged in patients of the main group from 0,5 to 2,5 dpt and averaged $1,95 \pm 0,06$ dpt. This is 1,8 times lower than SRA in the control group. NPCV was determined at the distance of $5,7 \pm 0,21$ cm from the eye in the main group of children before the beginning of refractive therapy, which is 3,6 cm less than in children with emmetropic refraction. The obtained data in the main group indicate low accommodative opportunities at the stage of formation of mild degree of myopia, which is consistent with the data of other researchers [1,5]. Then we traced to the dynamics of changes of indicators of accommodative function of the eye on the background of a course of refractive therapy, orthokeratology lenses Paragon CRT. Increasing of

RAA to $4,2 \pm 0,12$ dpt was noted within the first 3 months of refractive therapy. After 6 months RAA accounted $5,6 \pm 0,13$ and remained stable and statistically significantly higher than the original data by 4,2 times (p < 0,01). SRA Increase was observed in patients of the main group during the entire period by 2.5 times and amounted $3,82 \pm 0,07$ dpt up to 12 months of the follow-up period (p < 0,01). NPCV position changed from $5,7 \pm 0,21$ cm to $8,1 \pm 0,21$ cm, an average of 2,4 cm for the entire period of observation (p < 0,01). It is remarkable that the greatest increase in the studied parameters of accommodative function was observed during the first months of refractive therapy with orthokeratology lenses and subsequently we can see the stability of received parameters. Increasing of accommodative opportunities under the refractive therapy with orthokeratology lenses can be explained by the reduction and elimination of the accommodative imbalance that occurs in myopic eye in the absence of adequate optical correction. This is claimed by other researchers, who show data testifying about accommodative overloads of the eye caused by the use of glasses with hypocorrection of myopic refraction [2,6]. In earlier state of accommodation studies various methods of physical therapy on the eye accommodation apparatus, training exercises were widely proposed [7]. However, the scientific evidence base of recent years indicates the preference of full optical correction of myopia in children [2,3,6]. Therefore, the method of optical correction with orthokeratology lenses provides the normalization of the own accommodation not only the distance, but also close, it is confirmed by the data in our study, this method can serve as a method of choice for progressive myopia in children.

Conclusions

Application of refractive therapy, with orthokeratology lenses in patients with myopia helps to improve the functional state of the accommodative apparatus both distance and at close range, resulting in increasing of reserves of accommodation by 3,8 times, increasing the relative accommodation reserve by 2,8 times, as well as an increase in the nearest point of clear view by 2,4 cm.

Prospects for further research. Indicators of the accommodative function may be useful for monitoring the course of the process of myopia in children, and developing algorithm of differentiated approach to the appointment of means of optical correction in this disease.

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