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Influence of progressive and perifocal glasses for refraction, accommodation and muscle balance in children with progressive myopia

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Annotation

Spectacle correction can affect refraction, accommodation and muscle balance. The aim of this study is to study the effect of progressive and perifocal glasses on refraction, accommodation and muscle balance in children with myopia.

Material and methods. Were under supervision 116 children aged 7 to 17 years with myopia from –1.00 to –6.75 diopters with a gradient of progression - (0.80 ± 0.06) diopters per year, with binocular vision, with reduced reserve of relative accommodation (CAO) and / or binocular objective accommodative response (BAO). At the same time, 56 children were prescribed glasses with universal progressive lenses, 60 children - perifocal glasses with addition along the horizontal meridian.

Results. Across For 6 months of wearing glasses, refraction remained stable in both groups. The accommodative response did not change, the RVA in children who wore progressive glasses increased by (0.35 ± 0.08) diopters, in children who wore perifocal glasses - by (0.33 ± 0.04) diopters. In both groups, there was an increase in the number of cases of orthophoria. In two children wearing progressive glasses, the binocular nature of vision changed to simultaneous.

Conclusions. Permanent wearing of perifocal and progressive glassesinhibits the progression of myopia and increases the accommodative ability. Perifocal glasses are indicated for any type of muscle balance. Progressive glasses are indicated primarily for esophoria.

Key words: accommodative response, myopia, perifocal glasses, progressive glasses, phoria

Introduction

Spectacle correction of myopia with diffusing lenses is usually prescribed for changing focus from a position in front of the retina to a position on the retina. The visual result of this transfer is an increase in visual acuity. Single-vision, bifocal, sphero-prismatic glasses can be used to correct myopia [9, 10]. Earlier in our country glasses BSPO (bifocal sphero-prismatic glasses) were very popular, but there is no available scientific evidence of their effectiveness. For myopia correction, progressive glasses [5, 12] and glasses with perifocal defocus are also used [1, 2]. However, the appointment of corrective glasses for myopia affects not only distance visual acuity, but also accommodation and binocular balance.

The purpose of this study - explore the effect of progressive and perifocal glasses on refraction, accommodation and binocular muscle balance in children with myopia.

Material and methods

We observed 116 children aged 7 to 17 years with myopia from –1.0 to –6.75 diopters with a gradient of progression - (0.80 ± 0.06) diopters per year, with binocular vision for far and near, with a reduced margin of relative accommodation (CJSC) and / or an objective accommodative response (OJSC). At the same time, 56 children were prescribed glasses with universal progressive lenses with addition (0.75–2.00) diopters; the amount of addi- tion was chosen taking into account the values of the AOA and / or OAO [4]. And 60 children were fitted with perifocal glasses with an addition along the horizontal meridian of 2.5 diopters from the temporal side and 2.0 diopters from the nasal side.

Refraction was determined in vivo and after instillations of 1% solution of cyclopentolate. Along with the general ophthalmological examination, all patients were examined using binocular autorefkeratometer open-field image Grand Seiko WR-5100K (Japan), which allows to measure the refraction of the eye without correction, with optical correction in the conditions of BSPO binocular and binocular presentation of the object of fixation in the open field. Refraction was determined when looking into the distance (fixation target at a distance of 5 m). Based on the data obtained, corrective lenses were placed in the trial frame, completely compensating for the revealed ametropia and thereby inducing emmetropia in the subject. To control the induced refraction, repeated autorefractometry was performed. Dynamic refraction was measured under the conditions of corrective lens-induced emmetropy. Before the patient's eyes at a distance of 33 cm (accommodative task of 3.0 diopters), text No. 4 of the table for nearness was placed, corresponding to a visual acuity of 0.7, autorefractometry was performed with binocular text fixation. The obtained value of dynamic refraction corresponded to the objective binocular accommodation response (BAO) [3].

The margin of relative accommodation (RHA), the nature of vision using the four-point test, as well as the phoria for nearness were determined using a point light source and a Maddox cylinder at a distance of 33 cm.

results

Refraction

Before the appointment of progressive glasses, the manifest (non-cycloplegic) refraction averaged (3.65 ± 0.28) diopters, and the cycloplegic refraction was (3.32 ± 0.28) diopters. During 6 months of wearing progressive glasses, the mean manifest refraction remained stable. In 28.6% of cases, the overhead refraction decreased on average by (0.30 ± 0.29) diopters (from 0.12 to 0.75 diopters),

which was accompanied by an increase in distance visual acuity in progressive glasses by 0.1–0.3 rel. units, in 33.9% of cases - increased on average by (0.67 ± 0.11) diopters (from 0.63 to 0.88 diopters), which was accompanied by a decrease in distance visual acuity by 0.1 rel. units, and in 37.5% of cases it did not change. Cycloplegic refraction during 6 months of wearing progressive glasses was distinguished by exceptional stability and averaged (3.32 ± 0.28) diopters before and after wearing progressive glasses.

Before the appointment of perifocal glasses, the manifest (non-cycloplegic) refraction averaged (3.05 ± 0.29) diopters, and the cycloplegic refraction was (2.74 ± 0.21) diopters.

During 6 months of wearing perifocal glasses, the average manifest refraction increased by (0.15 ± 0.04) diopters. In 40.0% of cases, the manifest refraction decreased on average by (0.32 ± 0.29) diopters (from 0.12 to 0.88 diopters), which was accompanied by an increase in distance visual acuity in the perifocal lenses by 0 , 1–0.3 rel. units, in 23.3% of cases it increased on average (0.70 ± 0.21) diopters (from 0.63 to 1.25 diopters) and in 36.7% of cases it did not change.

Cycloplegic objective refraction after 6 months of using perifocal glasses changed from +0.25 to –1.25 diopters. The average shift of the cycloplegic objective refraction was + (0.02 ± 0.01) diopters. The average values of cycloplegic refraction before the appointment of perifocal glasses were - (2.74 ± 0.21) diopters, after 6 months of use in the mode of constant wear - - (2.72 ± 0.23) diopters.

Accommodation

Before the appointment of progressive glasses, the objective binocular accommodation response (BAO) was reduced in comparison with the calculated norm (for a distance of 33 cm with a lens strength of 3.0 diopters) [2, 3]) to - (1.79 ± 0.20) diopters. The lag of the accommodative response in 67% of cases was more than 0.75 diopters and averaged (1.21 ± 0.20) diopters.

After 6 months of wearing progressive glasses, BAO decreased on average by 0.12 diopters. In 36.6% of cases, it increased on average by (0.28 ± 0.40) diopters (from 0.12 to 0.62 diopters), in 63.6% it decreased on average by 0.24 diopters (from 0.12 to 0.50 diopters), in other cases it did not change. A lag in the accommodation response of more than 0.75 diopters was observed in 62.5% of cases. Its average value was (1.25 ± 0.40) diopters.

ZOA before the appointment of progressive glasses averaged (1.30 ± 0.14) diopters. After 6 months of wearing progressive glasses, this indicator increased on average by (0.35 ± 0.08) diopters. In 69.6% of cases, ORO increased by (0.81 ± 0.18) diopters on average, in 23.2% OA did not change, in 7.1% of cases it decreased on average by (1.05 ± 0.12) diopters. In 35.7% of cases, OTA reached normal age values.

Before the appointment of perifocal glasses, the BAO was reduced in comparison with the calculated norm and amounted to - (1.92 ± 0.20) diopters. The lag of the accommodative response in 86.7% of cases was more than 0.75 diopters [on average (1.08 ± 0.18) diopters].

After 6 months of wearing perifocal glasses, BAO increased on average by (0.10 ± 0.04) diopters. Moreover, in 62.5% of cases it increased on average by (0.30 ± 0.08) diopters (from 0.12 to 0.62 diopters), in 30.4% it decreased on average by (0, 25 ± 0.11) diopters (from 0.12 to 0.62 diopters) and in 7.1% of cases it did not change.

Before the appointment of perifocal glasses, the ZAA averaged (1.50 ± 0.15) diopters. After 6 months of wearing progressive glasses, that indicator increased) on average by (0.33 ± 0.04) diopters. In 51.8% of cases, it increased on average by (0.76 ± 0.09) diopters, in 1.8% of cases, ORA decreased by 1.03 diopters, in 46.4% of cases it did not change. In 40.0% of cases, the ZOA reached normal age values.

Binocular balance

Before glasses were prescribed in both groups, all children had binocular vision for distance and near, and this was the main condition for inclusion in both groups. After wearing progressive glasses in two cases (3.6%), the nature of vision changed. Across

6 months in one patient, binocular vision for near was replaced by simultaneous exotype, in another - simultaneous for distance and near exotype.

After 6 months from the beginning of wearing perifocal glasses, not a single case of changes in the nature of vision was revealed.

Before the appointment of progressive glasses, orthophoria for near was detected in 35.7% of cases, esophoria up to 8 prdptr - in 19.6% of cases, exophoria up to 6 prdptr - in 44.6%. Note that exophoria of more than 6 prdptr was regarded as a contraindication for the appointment of progressive glasses. In such cases, other correction methods were used.

After 6 months from the beginning of wearing progressive glasses, an increase in the number of cases of orthophoria by 1.25 times (44.6%) was noted. The decrease in the number of cases of esophoria occurred exclusively due to the transition of ezophoria up to 3 prdptr into orthophoria. The number of cases of phoria more than 3 prdptr did not change. The maximum value of esophoria at the end of the observation was 9 prdptr. Contrary to our expectations, the number of cases of orthophoria increased not only due to a decrease in cases of esophoria (after 6 months, the latter was detected in 16.1% of cases), but also due to a decrease in cases of exophoria - 39.3% of cases at the end of observation. However, along with a decrease in the number of cases of exophoria, cases of an increase in its values were revealed. Exophoria of more than 6 prdptr was recorded in 23.2% of cases (Table 1), its maximum enhancement in two cases was 12 and 16 prdptr, which was accompanied by a change in the nature of vision. In cases of a significant increase in exophoria for near, progressive glasses were replaced with single vision glasses or Perifocal-M glasses.

Before the appointment of perifocal glasses, near orthophoria was detected in 38.3% of cases, esophoria up to 6 prdptr - in 25.0% of cases, exophoria up to 10 prdptr - in 36.7%. Esophoria and exophoria more than 6 prdptr were not regarded as a contraindication for the appointment of perifocal glasses, if there were no signs of phoria decompensation.

After 6 months from the beginning of wearing perifocal glasses, an increase in the number of cases of orthophoria up to 41.7% was noted (Table 2). The incidence of esophoria was 28.3%. At the same time, a decrease in the values of exophoria was noted: in the initial state, esophoria in the range of 4–6 prdptr was detected in 8.3% of children, after wearing glasses with perifocal lenses - only in 3.3% of cases. In this case, the maximum value of esophoria was 5 prdptr. The number of cases of exophoria decreased to 30%, and a decrease in the magnitude of exophoria was also noted. There were no cases of increased esophoria and exophoria. There were no reasons for replacing peripheral glasses with a different type of correction due to changes in functional parameters.

Table 1

Patient distribution (n = 56) by the type and size of the phoria for nearness before and after the appointment of progressive glasses

Foria type	Before appointment			After appointment		
	The value of the phoria, prdptr	Amount of children		The value of the phoria, prdptr	Amount of children	
		n	%		*n*	%
Orthophoria	0	twenty	35,7	0	25	44.6
Esophoria	1-3 4-8	7 4	12.5 7.1	1-3 4-9	5 4	8.9 7.1
Exophoria	1-6	25	44.6	1-6 7-10 11-16	nine nine 4	16.1 16.1 7.1
Note. The interval of values of foria, prdptr, before the appointment of progressive glasses: –6 ... + 8, after their appointment: –16 ... + 9						

table 2

Patient distribution (n = 60) by the type and size of the phoria for nearness before and after the appointment of perifocal glasses (PO)

Foria type	Before assigning software			After assigning the software		
	The value of the phoria, prdptr	Amount of children		The value of the phoria, prdptr	Amount of children	
		n	%		*n*	%
Orthophoria	0	23	38.3	0	25	41,7
Esophoria	1-3 4-6	ten 5	16.7 8.3	1-3 4-5	15 2	25.0 3.3
Exophoria	1-6 7-10	19 3	31.7 5.0	1-6 eight	17 1	28.3 1.7

Note. The interval of values of phoria, prdptr, before the appointment of perifocal glasses: –10 ... + 6, after their appointment: –8 ... + 5.

conclusions

1. Permanent wearing perifocal and progressive glasses inhibits the progression of myopia and increases accommodative ability.

2. Perifocal glasses are shown when any b type of binocular muscle balance. Progressive glasses are indicated mainly for esophoria.

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The influence of progressive and perifocal glasses on refraction, accommodation and muscle balance in children with progressive myopia

In myopia correction with glasses is affected by the refraction, accommodation and muscle balance.

Purpose: to study the effect of progressive and perifocal lenses on refraction, accommodation and muscle balance in children with myopia.

Material and methods. 116 children aged 7 to 17 years with myopia from –1.00 to –6.75 D with progression gradient of - (0.80 ± 0.06) D per year, binocular nature of vision, reduced of positive relative accommodation (PRA) and / or binocular objective accommodation response (BAR) were observed. 56 children were prescribed glasses with universal progressive lenses, 60 children were prescribed perifocal glasses with addition to the horizontal meridian.

Results. After 6 months of wearing glasses refraction remained stable in both groups. OAR has been the same, positive relative accommodation (PRA) has increased in children wearing progressive glasses on (0.35 ± 0.08) D and increased in children wearing perifocal glasses on (0.33 ± 0.04) D. There was an increase in the number of cases of orthophoria in both groups. In two children wearing progressive glasses, the binocular nature of vision has changed to simultaneous.

Summary. The constant wearing of perifocal and progressive glasses inhibits the progression of myopia and increases the accommodation ability. Perifocal glasses can be used with any type of muscular balance. Progressive glasses can be used mainly in case of esophoria.

Keywords: accommodation response, myopia, perifocal glasses, phoria, progressive glasses

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