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ANALIZA REFRAKCIONIH ANOMALIJA KOD DECE UZRASTA DO 15 GODINA

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Analizirane su refrakcione anomalije dece uzrasta do 15 godina, pregledane u Kabinetu za ortooptiku i pleoptiku Klinike za očne bolesti KC Niš u petogodišnjem periodu (2006-2010), u odnosu na pol, uzrast ispitanika, vrstu i visinu refrakcione anomalije.

Od 620 dece kod koje nije postojalo organsko oštećenje oka, bilo je 292 muškog i 328 ženskog pola. Najbrojnija kategorija dece uzrasta je 7-9 godina (31.77%). Ispitivanja su obuhvatala određivanje oštrine vida, refrakcije oka, proveru motiliteta, konvergencije, cover test, orjentacionu proveru vrednosti intraokularnog pritiska, biomikroskopiju i direktnu oftalmoskopiju.

Od ukupno 1240 očiju, hipermetropija je nađena kod 671 oka (54.11%), miopija kod 37 (2.98%), astigmatizam kod 532 (42.91%) i to: hipermetropni astigmatizam kod 353 (28,47%), miopni astigmatizam kod 88 (7,10%) i mešoviti astigmatizam kod 91 oka (7,34%). U odnosu na visinu refrakcione anomalije dominiraju niska hipermetropija (do +3.0D u 73,18%) i niska miopija (do −3.0D u 70,27%). Kod astigmatizma, u najvećem procentu je razlika prelomne moći oba glavna meridijana <3D (hipermetropni 87.5%, miopni 75%); kod mešovitog astigmatizma najzastupljenija je miopija u jednom meridijanu do −1,5D i hipermetropija u drugom meridijanu <+3D. Direktni astigmatizam nađen je u 81.39%, inverzni u 9,21% i kosi astigmatizam u 9,40% ispitivane dece.

Hipermetropija i hipermetropni astigmatizam su najčešće refrakcione anomalije u ispitivanom uzorku dece (82,58%). Sa uzrastom dece zapaža se postepeni pad hipermetropije, porast miopije, miopnog i mešovitog astigmatizma. Ističe se značaj pravovremene i adekvatne korekcije refrakcionih anomalija dece. *Acta Medica Medianae 2012;52(2):33-40.*

Ključne reči: *refrakcione anomalije, miopija, hipermetropija, astigmatizam*

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Uvod

Refrakcija oka predstavlja odnos između moći prelamanja oka i njegove dužine, bez učešća akomodacije (1). Emetropno oko (emetropija) podrazumeva takav odnos između moći prelamanja i dužine oka da se svetlosni zraci koji dolaze iz daljine prelamaju i seku u makuli bez učešća akomodacije (2) i omogućavaju stvaranje oštrog, jasnog lika posmatranog predmeta.

Refrakcione anomalije (ametropije) nastaju kada je poremećen odnos moći prelamanja prema dužini oka. Obuhvataju: kratkovidost (myopia), dalekovidost (hypermetropia) i astigmatizam (astigmatismus) (2).

Miopija je refrakciona anomalija kod koje je moć prelamanja odveć jaka ili dužina oka odveć velika za postojeću moć prelamanja, tako da se paralelni svetlosni zraci koji dolaze iz beskonačnosti, nakon prelamanja kroz dioptrijski aparat oka bez upotrebe akomodacije, seku ispred mrežnjače gde nastaje lik posmatranog predmeta (3).

Nasuprot miopiji, kod hipermetropije je moć prelamanja odveć slaba ili dužina oka odveć mala, tako da lik posmatranog predmeta nastaje iza mrežnjače.

Astigmatizam (As.) je pojava nejednake refrakcije na jednom istom oku (3). Kod regularnog astigmatizma, paralelni svetlosni zraci iz beskonačnosti, nakon prelamanja, ne seku se u jednoj tački, već formiraju dve žižne linije koje nisu u istoj ravni, stoje pod pravim uglom, određuju osovine astigmatskog sistema (1,4); jedna odgovara najjače, a druga najslabije zakrivljenom meridijanu rožnjače i nazivaju se glavni meridijani. Zavisno od toga da li jače prelama vertikalni ili horizontalni meridijan, astigmatizmi mogu biti direktni - jače prelama vertikalni meridijan (astigmatismus directus) i inverzni - jače prelama horizontalni meridijan (astigmatismus inversus). Ukoliko je, pak, pravac glavnih meridijana kos, govori se o kosom astigmatizmu (astigmatismus obliquus) (5). Astigmatizam kod koga je jedan glavni meridijan

emetropan, a drugi ametropan (hipermetropan ili miopan), jednostavan je i naziva se astigmatismus simplex. Ukoliko u oba glavna meridijana postoji ametropija iste vrste, a različite jačine, u pitanju je astigmatismus compositus, a ukoliko je u jednom od glavnih meridijana refrakcija miopna, a u drugom hipermetropna, postoji mešoviti astigmatizam (astigmatismus mixtus) (3). Prelomna moć optičkog sistema izražava se u dioptrijama (D) (4). Visina refrakcione anomalije utvrđuje se skijaskopijom, odnosno refraktometrijom (2).

Cilj rada

Rad je imao za cilj analizu refrakcionih anomalija dece sagledavane u Kabinetu za ortooptiku i pleoptiku Klinike za očne bolesti KC Niš u petogodišnjem periodu u odnosu na pol, uzrast ispitanika, vrstu i visinu refrakcione anomalije.

Materijal i metode

Retrospektivno su se analizirale refrakcione anomalije dece koja su se javila u Kabinet za ortoptiku i pleoptiku Klinike za očne bolesti KC Niš u periodu od 2006 - 2010. godine, kod kojih nije postojalo organsko oštećenje organa vida. Ispitivanja su obuhvatala: određivanje subjektivne oštrine vida (na optotipima sa sličicama za mlađu decu predškolskog uzrasta sa udaljenosti od 3m, a za stariju decu predškolskog i decu školskog uzrasta na optotipima sa Pflüger-ovim kukama, indirektnom metodom), objektivne refrakcije oka (skijaskopija ili refraktometrija u cikloplegiji i midrijazi, u zavisnosti od uzrasta dece sa Sol. Homatropin 2% za decu školskog uzrasta ili Sol. Atropin 0,5% i 0,25% za decu predškolskog uzrasta), proveru motiliteta, konvergencije, cover test, orjentacionu proveru vrednosti intraokularnog pritiska, biomikroskopiju i direktnu oftalmoskopiju. Dobijeni rezultati prikazani su tabelarno.

Rezultati

Analizirane su refrakcione anomalije 620 dece uzrasta 1-15 godina, 292 muškog: 328 ženskog pola. Najveći broj dece je uzrasta 7-9 godina (31.77%), nešto više ženskog (52.90%) u odnosu na muški pol (47.10%). Distribucija pregledane dece po polu i uzrastu data je tabelarno (Tabela 1). Analiza svih refrakcionih anomalija, u zavisnosti od godina starosti, prikazana je tabelarno (Tabela 2), kao i procentualna zastupljenost refrakcionih anomalija za svaku uzrastnu grupu ponaosob (Tabela 3). Za astigmatizam su uzete refrakcione anomalije kod kojih je razlika prelomne moći oba glavna meridijana veća od 0.75 D. Za kosi astigmatizam uzeti su oni sa osovinom od 16º do 74º i od 106º do 164º.

Od ukupno 1240 očiju, hipermetropija je nađena kod n=671 oka (54.11%), miopija kod n=37 (2.98%), astigmatizam kod n=532 oka (42.91%) i to: hipermetropni astigmatizam kod 353 (28.47%), miopni astigmatizam kod 88 (7.10%) i mešoviti astigmatizam kod 91 oka (7.34%). U svim uzrastnim grupama, najčešća refrakciona anomalija bila je hipermetropija, najmanje je zastupljena miopija, osim u uzrastnoj grupi 13-15 godina, gde je zbirni astigmatizam (hipermetropni + miopni + mešoviti) češći od hipermetropije.

Posebno su analizirane i tabelarno prikazane refrakcione anomalije u odnosu na visinu refrakcione anomalije i godine starosti dece (za hipermetropiju Tabela 4 i miopiju Tabela 5). Najzastupljenija je kategorija sa niskom hipermetropijom do +3.0D n=491 oka (73.18%). Od 37 oka sa miopnom refrakcijom, niska miopija do –3.0D nađena je kod 26 očiju (70.27%).

Astigmatizam je posebno tabelarno prikazan i to: As. hypermetropicus (Tabela 6), As. myopicus (Tabela 7) i As. mixtus (Tabela 8).

Kod hipermetropnog astigmatizma, u najvećem procentu (87.5%), visina astigmatizma (razlika prelomne moći glavnih meridijana) je <3D i to: sa visinom hipermetropije u jednom meridijanu do +3.0D je 51.8%; od +3.25 do +6.0D je 26.9%; od +6.25 do +9.0D je 7.6%; od +9.25 do +12.0D je 0.9% i sa hipermetropijom ≥ + 12.25 D je 0,3%. Astigmatizam ≥3D zastupljen je u 12.5%, u najvećem procentu (10.2%) je kod visine hipermetropije u jednom meridijanu do +3.0D.

Kod miopnog astigmatizma, u najvećem procentu, visina astigmatizma je <3D (75%): sa visinom miopije u jednom meridijanu do –3.0D je 42.1%; od –3.25 do –6D je 18.2%; od –6.25 do –9.0D je 7.9%, od –9.25 do –12.0D je 4.5% i sa visinom miopije ≥ –12.25 D je 2.3%. Astigmatizam ≥3D zastupljen je u 25%, i to u 11.4% kod visine miopije u jednom meridijanu do –3D i u 13.6% kod većih miopija u jednom meridijanu.

Kod mešovitog astigmatizma u 59.34% visina miopije u jednom meridijanu je od –0.25 do –1.5D (u 49.45% visina hipermetropije u drugom meridijanu <+3.0D, a u 9.89% ≥+3.0D), u 26.38% visina miopije u jednom meridijanu je od –1.75 do –3.0D (u 24.18% visina hipermetropije u drugom meridijanu <+3.0D, a u 2.20% ≥ +3D); u 7.69% visina miopije u jednom meridijanu iznosi od –3.25 do –4.50D (u 6.59% visina hipermetropije u drugom meridijanu <+3.0D, u 1.1% ≥+3D), dok su u nešto manjem procentu (6.6%) zastupljeni astigmatizmi sa visinom miopije u jednom meridijanu ≥ –4.75D i visinom hipermetropije u drugom meridijanu <+3.0D.

U tabeli 9 data je zastupljenost direktnih, inverznih i kosih astigmatizama za svaku uzrastnu grupu ponaosob. Najzastupljeniji je direktni astigmatizam (81.39%), a skoro podjednako zastupljeni su inverzni (9.21%) i kosi astigmatizam (9.40%).

Tabela 1. Distribucija dece po polu i uzrastu

Uzrast	Pol n (%)		Σ n (%)
(god)	Muški	Ženski	
1-3	52	50	102 (16.45%)
4-6	91	80	171 (27.58%)
7-9	87	110	197 (31.77%)
10-12	45	62	107 (17.26%)
13-15	17	26	43 (6.94%)
Σ	292(47.10%)	328 (52.90%)	620 (100%)

Tabela 2. Refrakcione anomalije u zavisnosti od godina starosti

Uzrast (god)	Refrakcione anomalije					Σ
	Hyperopia	Myopia	As. Hyperopic	As. Myopic.	As. Mixtus	
1-3	140	5	42	11	6	204
4-6	188	6	124	13	11	342
7-9	203	7	119	31	34	394
10-12	102	11	54	23	24	214
13-15	38	8	14	10	16	86
Σ %	671 (54.11%)	37 (2.98%)	353 (28.47%)	88 (7.10%)	91 (7.34%)	1240 (100%)
			532 (42.91%)			

Tabela 3. Procentualna zastupljenost refrakcionih anomalija za svaku uzrastnu grupu ponaosob

Uzrast (god.)	Refrakcione anomalije										Σ	
	Hyperopia		Myopia		As. Hyperop.		As.Myopic		As.Mixtus			
	n	%	n	%	n	%	n	%	n	%	n	%
1-3	140	68.63	5	2.45	42	20.59	11	5.39	6	2.94	20	100
4-6	188	54.97	6	1.75	124	36.26	13	3.80	11	3.22	342	100
7-9	203	51.52	7	1.78	119	30.20	31	7.87	34	8.63	394	100
10-12	102	47.66	11	5.14	54	25.23	23	10.75	24	11.22	214	100
13-15	38	44.19	8	9.30	14	16.28	10	11.63	16	18.61	86	100

Tabela 4. Visina hipermetropije u D u zavisnosti od uzrasta dece

Uzrast (god)	Visina hipermetropije (D)					Σ	
	+0.25 to +3.0	+3.25 to +6.0	+6.25 to +9.0	+9.25 to +12.0	+12.25 to +15.0	n	%
1-3	74	59	7	0	0	140	20.90
4-6	137	42	7	2	0	188	28.02
7-9	163	29	9	1	1	203	30.25
10-12	83	14	5	0	0	102	15.20
13-15	34	3	0	1	0	38	5.66
Σ	491(73.18%)	147(21.90%)	28(4.17%)	4(0.60%)	1(0.15%)	671	100

Tabela 5. Visina miopije u D u zavisnosti od uzrasta dece

Uzrast (god)	Visina miopije (D)					Σ	
	-0.25 to -3.0	-3.25 to -6.0	-6.25 to -9.0	-9.25 to -12.0	-12.25 to -15.0	n	%
1-3	2	1	1	0	1	5	13.51
4-6	2	0	1	3	0	6	16.22
7-9	5	2	0	0	0	7	18.92
10-12	9	1	0	1	0	11	29.73
13-15	8	0	0	0	0	8	21.62
Σ	26(70.27%)	4(10.81%)	2(5.41%)	4(10.81%)	1(2.70%)	37	100

Tabela 6. Visina hipermetropnog astigmatizma u zavisnosti od godina starosti

Uzrast (god)	Visina hipermetropije na jednom meridijanu (D)										
	E to+3.0		+3.25to+6.0		+6.25to+9.0		+9.25to+12.0		+12.25to+15.0		Σ
	RD	RD	RD	RD	RD	RD	RD	RD	RD	RD	
	<3.0	≥3.0	<3.0	≥3.0	<3.0	≥3.0	<3.0	≥3.0	<3.0	≥3.0	
1-3 d	11	6	15	2	4	0	0	0	0	0	38
1-3 I,k			4*								4*
4-6 d	52	6	30	2	10	1	2	0	0	0	103
4-6 I,k	3*6#	2*	5*4#		1#						10*11#
7-9 d	65	11	15	2	5	0	1	0	1	0	100
7-9 I,k	7*2#	4#	3*1#		2*						12*7#
10-12 d	25	6	10	0	4	1	0	0	0	0	46
10-12I,k	3#	1#	4#								8#
13-15 d	7	0	3	0	1	0	0	0	0	0	11
13-15I,k	2#		1#								3#
∑ d	160	29	73	6	24	2	3		1		298
∑ I,k	10*13#	2*5#	12*10#		2*1#						26*29#
∑	183	36	95	6	27	2	3		1		353
%	51.8%	10.2%	26.9%	1.7%	7.6%	0.6%	0.9%		0.3%		100%

RD: razlika prelomne moći oba glavna meridijana u D
d: direktni astigmatizam
I : * inverzni astigmatizam, k: # kosi astigmatizam

Tabela 7. Visina miopnog astigmatizma u zavisnosti od godina starosti

Uzrast (god)	Visina miopije na jednom meridijanu (D)										
	E to-3.0		-3.25to-6.0		-6.25to-9.0		-9.25to-12.0		-12.25to-15.0		Σ
	RD	RD	RD	RD	RD	RD	RD	RD	RD	RD	
	<3.0	≥3.0	<3.0	≥3.0	<3.0	≥3.0	<3.0	≥3.0	<3.0	≥3.0	
1-3 d	2	2	2	0	0	0	3	0	2	0	11
1-3 I,k											
4-6 d	4	2	2	2		0	0	0	0	1	11
4-6 I,k	1*				1*						2*
7-9 d	10	0	6	1	4	2	0	0	0	1	24
7-9 I,k	2*3#		2*								4*3#
10-12d	5	3	4	1	1	1		0	0	0	15
10-12 I,k	3*	1#			1#	2#	1#				3*5#
13-15d	3	2	0	0	0	1	0	0	0	0	6
13-15I,k	3*1#										3*1#
∑d	24	9	14	4	5	4	3		2	2	67
∑I,k	9*4#	1#	2*		1*1#	2#	1#				12*9#
∑	37	10	16	4	7	6	4		2	2	88
%	42.1%	11.4%	18.2%	4.5%	7.9%	6.8%	4.5%		2.3%	2.3%	100%

RD: razlika prelomne moći oba glavna meridijana u D
d: direktni astigmatizam
I : * inverzni astigmatizam, k: # kosi astigmatizam

Tabela 9. Zastupljenost direktnih, inverznih i kosih astigmatizama za svaku uzrastnu grupu posebno

Uzrast (god)	Astigmatizmi			∑
	direktni	direktni	direktni	
1-3	53(89.83%)	6(10.17%)	0	59(100%)
4-6	123(83.12%)	12(8.11%)	13(8.78%)	148(100%)
7-9	153(83.15%)	16(8.70%)	15(8.15%)	184(100%)
10-12	75(74.26%)	8(7.92%)	18(17.82%)	101(100%)
13-15	29(72.50%)	7(17.50%)	4(10.00%)	40(100%)
Σ	433(81.39%)	49(9.21%)	50(9.40%)	532(100%)

Tabela 8. Visina miopije i hipermetropije u D kod mešovitog astigmatizma u zavisnosti od godina starosti

Uzrast (god)	Visina miopije u jednom i hipermetropije u drugom meridijanu u D										
	-0.25 to-1.50		-1.75 to-3.0		-3.25 to-4.50		-4.75 to-6.0		-6.25 to-7.50		
	mII		mII		mII		mII		mII		Σ
	<+3.0	≥+3.0	<+3.0	≥+3.0	<+3.0	≥+3.0	<+3.0	≥+3.0	<+3.0	≥+3.0	
1-3 d	2	2									4
1-3 I,k	2*										2*
4-6 d	4	1	4								9
4-6 I,k			1#	1#							2#
7-9 d	13	3	9		2				2		29
7-9 I,k	1#	2#	2#								5#
10-12 d	7	1	1			1	4				14
10-12 I,k	4*1#		1*1#	1#	2#						5*5#
13-15 d	8		2		2						12
13-15 I,k	3*		1*								4*
Σ d	34	7	16		4	1	4		2		68
Σ I,k	9*2#	2#	2*4#	2#	2#						11*12#
Σ	45	9	22	2	6	1	4		2		91
%	49.45	9.89	24.18	2.20	6.59	1.10	4.40		2.20		100%

mII: Visina hipermetropije u drugom meridijanu
d: direktni astigmatizam
I : * inverzni astigmatizam, k: # kosi astigmatizam

Diskusija

Investigation of refractive anomalies is of particular importance in pediatric population, because they are the most common cause of amblyopia and strabismus, if detected late. It is important to timely determine the existence, amount and the difference of refractive anomalies in both eyes in these patients, who are in vulnerable population, with well established screening of preschool and early school aged children.

Refraction of the eye changes through life. During the growth of the eye, the process of emmetropization normally occurs i.e. harmonization of refractive and axial parameters and formation of emmetropic relations within normal biological variation. Hyperopia, from +3.0D to +4.0D at birth, decreases during the preschool period to +0.50D, emmetropy or even converges to myopia (2).

For the development of refractive anomalies primarily genetic factors are responsible, up to 86% in terms of myopia and hyperopia, and 50% in terms of inheritance of the total or 60% of corneal astigmatism (Hammond CJ, et al. (2001)). In addition to genetic factors, for the development of refractive anomalies, other - non-genetic factors are important (SM Saw, 2003). In the case of myopia, those are: close work, TV watching, computer work, working conditions (Cvetković, 1995), general state of the organism, the activity of the endocrine system, weakened accommodation, bulbomotor and eyelid muscle activity, uncoordinated relationship of intraocular pressure and rigidity of sclera (Sheedy, JE, et al. (2003)), education (Diran, M, et al. (2008)), urbanization (Morgan, et al. (2005)) and others, while in the other hand the astigmatism is connected with: lack of coordinated development of fibrous layer of the eye, the position and shape of the lens, an anomaly of development posterior pole of the eye (the insertion of hair papilla, coloboma of the optic nerve and surrounding choroid) (Cvetković, 1995), pressure of the eyelids and bulbomotor, intraocular pressure effects, the effects of surgery, diseases of the eye, adnexa, genetic syndromes associated with abnormalities of the eyelids and the like (6).

According to the results obtained in 620 children (in 1.240 examined eyes) hyperopia was present in 54.11%, myopia in 2.98%, astigmatism in 42.91% (hyperopic in 28,47%, myopic in 7.10% and mixed in 7.34%). Hyperopia and hyperopic astigmatism are the most common refractive anomalies, which is in accordance with results and other authors (7-16). Some differences in the percentage distribution of refractive anomalies in certain authors may be explained by the different age structure, geographical/racial background of the children, working methodology.

According to the amount of refractive anomalies low hyperopia up to +3.0D (73.18%) was the most prevalent in all age groups of children, which is also in accordance with the results of other authors (17,18,13). High hyperopia over +8.0 or +10.0D are otherwise rare, with only 0.18% having the refraction higher than +10.0D (2).

The frequency of occurrence of astigmatism in the overall population and among refractive anomalies vary from one author to another, usually because of differences in definition of (clinical) astigmatism. Astigmatism relatively rarely manifests as isolated refractive anomaly. Over 4/5

of all astigmatism occurs in combination with hyperopia/myopia, more common in females (6:4) and can be changed in the course of life (2).

We observed, in our work, a gradual decline in the representation of hyperopia and hyperopic astigmatism with aging of children. These results agree with the results of other authors who recorded negative prevalence of hyperopia with age (10,15,19), as well as those who recorded a decline in the percentage of the hyperopic astigmatism with age (20). In contrast to hyperopic, increase in percentage of myopic and mixed astigmatism, in our work, relates to aging of children and is associated with myopisation of the eye with age. Shih et al. (2004) record an increase in percentage of myopic, and decline of mixed astigmatism with age (20).

In the analysis of astigmatism, there is a significant difference of the refractive powers of both principal meridians of the eye of the children, which in our sample was usually <3D (with hyperopic astigmatism in 87.5%, and myopic astigmatism in 75% of respondents). Gong et al. (2004) also found only a small percentage of astigmatism ≥3D (21). In mixed astigmatism, the majority of children were with a height of myopia in one meridian to -1.5D and hyperopia height of less than +3.0D in the second meridian. In all astigmatism cases (hyperopic, myopic, and mixed) direct astigmatism was the most common, which matches the findings of other authors (20,22). Direct representation of astigmatism in our sample decreases with age in children. Shih YF (2004) provides an increase in direct astigmatism, the decrease of the inverse, while the oblique astigmatism is generally stable with age, in children (20).

Myopia is a refractive anomaly the least represented in our study (2.98%). The prevalence of myopia shows a wide geographic variation. Mild to moderate myopia occurs in about 25% of the population of Europe and North America, only about 5% of the population in Africa, and even 61% in Asia (23). The prevalence of myopia in adolescents in the recent decades has increased and is 10-25% and 60-80% in industrialized societies of the West and the East (24). It is estimated that 1.6 billion people worldwide have myopic refractive anomaly, and it is expected that this number will increase to nearly 2.5 billion by 2020 (Diran et al. (2006)), which indicates that myopia is becoming a significant global health problem (6).

Myopia is usually present as low, in this sample of children with height up to -3.0D (70.27%) according to the results of other authors (13). It tends to increase with aging of children, which is also in accordance with the results of other authors who found a positive correlation between the prevalence of myopia and age (15,19). A higher percentage prevalence of myopia in the youngest children in relation to the age group of 4-6 years is interpreted by the height of myopia and poorer eyesight previously observed, and the increase in the level of myopia with age explains the influence of these non-genetic factors, particularly the activity of the growing closeness and anthropometric measures. It would be desirable for a future announcement regarding the analysis of refractive errors to include the right interpretation of anthropometric measures with biometric and keratometric parameters of eyes in respondents with further interpretation of the emergence and change of the refractive status of the eye during life. Timely and proper monitoring and correction of refractive errors contributes to reducing visual impairment and the chance to form the youngest patient population, our children, the hope and future of the country.

Conclusion

From the observed refractive anomalies in children, hyperopia and hyperopic astigmatism in relation to myopia, myopic astigmatism and mixed astigmatism are usually represented.

In relation to the amount of refractive anomalies, the most common refractive anomalies are up to +/−3D. The most common are hyperopic and myopic astigmatism cases, with the difference of refraction power between the two principal meridians <3.0D, while in mixed astigmatism it is myopia in one meridian up to -1.5D and hyperopia <+3.0D in the second meridian. Direct astigmatism is more common, while the inverse and oblique are present in almost equal proportion.

Although in our sample low refractive anomalies and fewer high values of refractive anomalies dominate, timely detection, adequate correction and monitoring of refractive anomalies is necessary in order to prevent poor eyesight and strabismus.

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ANALYSIS OF REFRACTIVE ERRORS IN CHILDREN AGED UP TO 15 YEARS

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Investigation of refractive anomalies is especially important in the pediatric population, because they can be the cause of amblyopia and strabismus, if detected late.

We analyzed the refractive anomalies of children aged up to 15 years who were examined in the Office of the Orthoptics and Pleoptics - Department of Ophthalmology - Clinical Center Niš during a five-year period (2006-2010) in relation to sex, age of respondents, type and amount of refractive anomalies. The study included the determination of visual acuity, eye refraction, motility, convergence, cover test, biomicroscopy and direct ophthalmoscopy.

Among the 620 children, without organic damage to the eye, there were 292 males and 328 females. Hyperopia was found in 54.11%, myopia in 2.98%, astigmatism in 42.91%, primarily hyperopic astigmatism in 28.47%.

Hyperopia and hyperopic astigmatism-related refractive anomalies are the most common in this sample of children. The importance of timely and adequate correction of refractive anomalies in children to prevent amblyopia and strabismus is emphasized. *Acta Medica Medianae 2013;52(2):33-40.*

Key words: *refractive anomalies, myopia, hyperopia, astigmatism*

