

НОВИНЕ У ПРОЦЕНИ И ТРЕТМАНУ ОСОБА СА ОШТЕЋЕЊЕМ ВИДА
ЗБОРНИК РАДОВА

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ЗБОРНИК РАДОВА

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STRABISMUS AT CHILDREN AND ITS INFLUENCE ON FUNCTION OF BINOCULAR VISION

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The purpose of this research is to examine functionality of binocular eyesight after surgery in case of esotropia as well as examine a size of strabismus angle, age, and their influence on strengthening of binocular eyesight after surgery in case of esotropia. The research covers 57 examinees with esotropia who underwent a surgery. Data used herein were collected on the basis of history data of examinees treated at Department for orthoptic and pleoptic of the Clinic for eye diseases, University Clinical Center Tuzla. Their age is from 3 to 14. The research includes three period of observation: first – initial examination, a period after surgery and a year after surgery. The examinees were divided into two age groups: 3-6 and 7-14. SPSS 17.0 for Windows program package was used for data processing applying analysis of a variant (ANOVA), i.e. p-value, hi-square test (dependence test). Upon completion of data processing, taking into consideration results obtained, it may be concluded that better results were reached at younger age examinees, aged 3-6, expressed in decrease of strabismus angle size and higher percentage presence of binocular eyesight a year after surgery, in comparison to age examinee 7-14. Research results indicate need for prompt treatment, early detection, i.e. early systematic examinations of pre-school children and prevention of strabismus and amblyopia.

Key words: esotropia, age, visual acuity, strabismus angle size, amblyopia, binocular eyesight, orthoptic pleoptic therapy, prevention, systematic examinations

INTRODUCTION

Strabismus is a condition in which the eyes are not properly aligned and a disorder of binocular vision function (Čelić and Dorn, 2004). Strabismus can be concomitant (strabismus concomitans) or caused by paralysis of some eye muscles (strabismus paralyticus). In case of concomitant strabismus, the angle of squint is always equal, regardless of

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which eye is fixing, whether the squint is monocular or alternating, what the view is directed to and how far the observed object is. Here comes the term “following” or “concomitant” strabismus, because the squint eye always follows the other one in the permanent relation (Litričin, Blagojević i Cvetković, 2004).

Strabismus at child age is mainly concomitant. Their characteristic is motor anomaly or non-parallelism of view axes. Motor anomaly very quickly causes sensor disorders. In the basis, there are neurophysiologic dysfunctions of several brain structures but also refraction anomalies (Lakoš-Krželj, 2004). The consequences of strabismus are: suppression of squint eye, anomaly retinal correspondence, amblyopia and eccentric fixation (Stanković, 1995).

Esotropia usually appears up to the age of 3, and sometimes upon birth or during the first year of life. Convergent strabismus is the most frequent type of squint, especially at child age. Esotropia is eye deviation inward (Čelić and Dorn, 2004). About 90% of all esotropia have hypermetropia caused by refraction anomalies, often combined with astigmatism, while the remaining 10% have normal vision or suffer from myopia. (Serdarević, 1996). Convergent strabismus is the most frequent type of squint, especially at child age. Monocular forms prevail over alternating, but among them one eye is leading very often, mainly stands normally, and only sometimes goes to a squint position. There is a significant prevalence of esotropia, which mainly varies from 90% to 96% cases, while exotropia varies from 0-8% cases (Kim, Hwang, Kim, Yu, 2002). Early form of convergent strabismus is frequent, it may appear very early and become noticeable immediately upon birth or during the first two years of life. Refraction anomalies are small or not evident at all, but the angle is higher (Čelić and Dorn, 2004).

Late forms of convergent strabismus appear after the age of two and are often accommodative strabismus whose development was contributed by refraction anomaly – hypermetropia. In the beginning, this esotropia is periodical and usually appears at near vision and when a child is tired. If binoculars are prescribed at this stage to correct hypermetropia, then increased accommodation disappears and therefore impulse for convergence and esotropia, too. On the other hand, periodical esotropia

becomes permanent, which leads to sensor disorders (Litričin, Blagojević and Cvetković, 2004).

Convergent strabismus at early stage, appearing at the age of 1 to 3, strabismus starts suddenly. The angle of squint is constant, squint is more-less alternating with application of one eye dominance, and there is poor sight with eccentric fixation. Binocular sight is disturbed as it had no time for development. Thus we have anomaly retinal correspondence. Late convergent strabismus develops at the age of 3 to 7, when sensor relations are established. They usually appear suddenly and are accompanied by short-lasting diplopia. Acuity is good, refraction error insignificant or missing, but amblyopia rarely appears. Binocular vision is maintained and we find normal retinal correspondence (Sefić, 1998). Microstrabismus – This type of strabismus is characterized by a small angle of squint, usually convergent resistance of up to 5°. There is regularly present anomaly retinal correspondence, trained binocular vision and poor sight of different degree, which speaks for a small motor, but significantly sensor disorder. It appears immediately upon birth, usually in big families. It is detected lately, usually prior to school enrollment, because esthetic impression is satisfying. Amblyopia may be of different degree, but a hard form of amblyopia is also indicated with eccentric fixation of up to 50%. Binocular vision is not useless and microstrabismus often remains compensated during the life (primary microstrabismus), but it can be decompensated. Secondary microstrabismus can appear after a surgery or wrong correction, but also spontaneously. It is important to detect it as early as possible in order to have a more effective treatment of amblyopia, while ARK cannot be affected (Bradamante and co., 1994). A and V syndromes or alphabetic syndrome is in practical use, although some people think it is not regular. For this type of strabismus it is typical that elevation and depression of eye can change the size of horizontal resistance. It is considered that a mutual relationship between slope and plane synergists and antagonists is disturbed. There are the following forms of A and V syndromes: V esotropia – convergent resistance is higher when looking down; A esotropia – convergent resistance is higher when looking up; V exotropia – divergent resistance is higher when looking up; A exotropia – divergent resistance is higher when looking

down (Bradamante and co., 1994). It is usually said that every fifth patient with strabismus has some form of A or V syndrome. V esotropia is the most frequent, and then comes A esotropia, V exotropia and finally A exotropia. V form is met at about 60% cases, while A form of strabismus at 36% cases (Noorden, Campos, 2002). Patient suffering from A and V syndromes complain about asthenopic disturbances and double images, especially when working in near and have a forced head position. It is important to precisely make a clinical test in order to make a decision of proper treatment. Surgery is a necessary method of treatment. (Risović and Vicić, 2008.).

PURPOSE OF RESEARCH

To examine differences in size of angles in case of strabismus at initial examination, immediately upon the first surgery and a year after the surgery.

METHOD OF OPERATION

SAMPLE OF EXAMINEES

The research includes 57 examinees, 29 females and 28 males. They are 3 to 14 years old.

In order to determine at what age a surgery and orthoptic pleoptic exercises provide best conditions for reaching binocular eyesight, examinees were divided into two age groups: 3-6 year olds and 7-14 year olds.

Amblyopia (poor eyesight), as accompanying phenomenon, was present at 36 examinees, while 22 of them were without amblyopia.

SAMPLE OF VARIABLES

The research includes examination of multiple perception of characteristics. The examined independent variables are: age, eyesight acuity on the right and left eye, strabismus angle size, and amblyopia, while dependent variable is a binocular vision.

MODE OF RESEARCH CONDUCTION AND INSTRUMENTS OF MEASUREMENT

Data used for this research were gathered on the basis of history of patients processed and treated at Department for orthoptic and pleoptic, Clinic for eye diseases, UCC Tuzla.

Criteria for data processing were examinees with esotropia (convergent strabismus), who were performed a surgery. The research was conducted in three periods of observation: the first (initial) examination, immediately after surgery and a year after surgery, including orthoptic pleoptic exercises. The following methods were used within the research: analysis of medical documentation, examination of eyesight acuity, refraction, examination of eye motility and oculomotor balance of eye muscle, cover-uncover test, measurement of objective deviation, i.e. of objective angle of strabismus (on synaptophore with obliged altering occlusion before measuring the angle), examination of binocular vision (on synaptophore).

DATA PROCESSING METHODS

SS 17,0 for Windows program package SP was used for data processing.

For observed variables at each examination, for every group of examinees established according to their age, measures of central tendency, measures of dispersion and quartiles were calculated. To test presence difference of middle values among the groups established according to the age of patients (independent samples), and according to other criteria, analysis of variance (ANOVA), i.e. p-value, was applied. To see whether there is a statistically significant connection (interdependence) among some variables, a dependence test, i.e. Chi-square test was applied.

RESULTS

Prevalence of strabismus shows huge variations in different ethnic groups and populations. The highest frequency is at European and English population and is present at 3 to 5% of school children (Miller, 2005).

Analyzing research data, it was established that the lowest measured angle of 17° was at first initial examination, which was the condition, i.e. indication for surgery, and was taken as initial measurement for group formation. The first group is composed of examinees with $<17^\circ$ angle, while the second and the third group are composed of examinees with angles of $+18^\circ$ to $+25^\circ$ and $+26^\circ$ to $+35^\circ$ established for overview of obtained results. The fourth group is composed of examinees with an angle of more than $+35^\circ$ because there is a high probability for performing surgery again, i.e. that the first surgery cannot remove such a great angle of deviation. Hereinafter there are presented data about values of strabismus angle (esotropia) at initial examination, immediately after the surgery and a year after the surgery as the final examination in respect to the age of examinees. What is important is that before the surgery, i.e. at initial examination, only one examinee has an angle of up to 17° .

Table 1 shows the above mentioned data for the group of examinees aged 3 to 6. According to the results shown in Table 1, the values of chi-square and empiric level of significance (p-value) which is lower than 0,05 (5% of the level of significance on which testing was made), we may conclude that in case of this aged group there is a statistically more significant dependence of value of strabismus angle on the time of medical examination. So, one can see that the least examinees at first initial examination has a strabismus angle of up to 17° , i.e. (2,60%). During the period of one year after the surgery, it can be noted that the highest number of examinees, (92,30%) of them, has a residual angle of up to 17° , which means that angle size has decreased. When it is about examinees with a strabismus angle of $26-35^\circ$, which was the most frequent at the first initial examination (53,80%), during the period of one year after the surgery this angle size was not present anymore (0%), which means that there was a significant decrease of strabismus angle (esotropia) at examinees aged 3 to 6. On the basis of obtained results, we may conclude that preoperative preparation and a surgery itself have a positive effect on significant decrease of strabismus angle.

Table 1 – Angle strabismus age group 3-6 years

The angle of strabismus	Time of inspection					
	The first review		After surgery		One year after surgery	
	f	%	f	%	f	%
do 17	1	2,60	36	92,30	33	84,60
18-25	16	41,00	3	7,70	6	15,40
26-35	21	53,80	0	0,00	0	0,00
> 35	1	2,60	0	0,00	0	0,00
In total	39	100,00	32	100,00	57	100,00
$\chi^2=87,377$; df = 6; p=0,000						

Table 2 shows the above mentioned data relative for a group of examinees aged from 7 to 14. According to the results from table 2, values of hi-square and empiric level of significance (p-value) which is lower than 0,05 (5% of the level of significance on which testing was made), we may conclude that in case of this aged group, too, there is a statistically significant dependence of value of strabismus angle on the time of medical examination. So, one can see that a strabismus angle of up to 17° is the lowest at the first examination, i.e. (5,30%). During the period of one year after the surgery, it was noted that most of examinees (84,20%) had a residual angle of up to 17°, which means that strabismus angles has decreased. Further on, we can see that strabismus angle of up to 17° at older patients is less present at this group (older) of examinees than in case of examinees aged from 3 to 6 (younger examinees with relative presence of 92,30%). In table 2 we can see that 73,70% examinees of the second age subgroup at initial examination has a strabismus angle from 18° to 25°, while in the final examination we can see that this strabismus angle remained at 15,80% of examinees. It is supposed that these examinees will be subjected to re-surgery which shall be a decision of an ophthalmologist-surgeon. While 5,30% of examinees had a strabismus angle fro 26° to 35° at initial examination, 15,80% of examinees had a strabismus angle higher than 35°, which is a quite big angle of deviation. In the final examination, it was noted that none of examinees had such a big strabismus angle. On the basis of these results, it can be concluded that a surgery has influence on decrease of strabismus angle. According to the above mentioned, when it is about a size of strabismus angle, we may say that its values are different,

i.e. statistically significant at first initial examination, immediately upon a surgery and a year after the surgery at both groups of examinees. On the basis of these results, we can see that strabismus angle is influenced by age and time of examination, which brings us to a conclusion that decrease of strabismus angle is influenced by surgery and appropriate post-surgical treatment.

Table 2 – Angle strabismus age group 7-14 years

The angle of strabismus	Time of inspection					
	The first review		After surgery		One year after surgery	
	f	%	f	%	f	%
do 17	1	5,30	16	84,20	16	84,20
18-25	14	73,70	3	15,80	3	15,80
26-35	1	5,30	0	0,00	0	0,00
> 35	3	15,80	0	0,00	0	0,00
In total	39	100,00	32	100,00	57	100,00
$\chi^2 = 33,736$; df = 6; p = 0,000						

DISCUSSION

If treatment is combined with binoculars, orthoptic-pleoptic treatment does not reach a desired effect, i.e. removal of deviation and improvement of binocular vision. In this case, one should be subjected to surgery. A huge deviation angle requires a surgical treatment because no other method of treatment can remove it. A surgical treatment has psychological reasons for esthetic appearance and social reasons because it is known that orthoptic-pleoptic treatment is not acceptable to many patients because of its financial expenses. Time of surgery at congenital or infantile esotropia is different at some authors. Some of them speak for early surgeries, up to the first year of life, while the others speak for a surgery between the age of 2 and 3. (Bradamante, 1994). Simonsz (2006) conducted a study to investigate early surgeries of congenital strabismus in relation to late surgeries of congenital strabismus. Optimal age for surgery of congenital esotropia is different at many authors. Those for early surgery believe that further loss of binocular may be prevented by

early surgery, while some of them believe that binocular vision can be maintained by early surgery. This study made a comparison between early and late surgeries. Children in early age (6-34 months), 231 children, and those aged 32-60 months, 301 of them, underwent a surgery. All of them were determined a strabismus angle, refraction anomaly, a degree of amblyopia and limited abduction. The children were re-examined at the age of 6, when a degree of binocular vision, strabismus angle and remaining amblyopia were determined. Refraction errors, amblyopia and limited abduction were equal in both groups of examinees, but a strabismus angle was a bit higher at younger examinees. At the age of 6, 13,5% of children who underwent a surgery at early group in respect to 3,9% of children in late group had a stereovision examined by Titmus test. Considering strabismus angle, there was no difference in both groups. When it is about acuity, early group had small, but significant advantage. In both groups there were children who had to be subjected to re-surgery at the age of 6. The authors think that children who underwent a surgery at early age had better acuity and stereovision at the age of 6 in comparison with children who underwent a surgery at later age.

The study conducted by Alajbegović-Halimić (2003), in duration of three years, included 246 children from 4 to 6. Its aim was to determine a level of visual activity at children, following results of occlusion therapy of esotropic and anisometropic group and analyze factors of effect on reached results. Analyzing factors of influence, they arrived at conclusion that all-day occlusion at esotropic amblyopia represents the best choice of treatment. A gained visus of 0,5 was considered a good result or better on amblyopic eye.

Similar research was conducted by Krković and co (2003), whose aim was to establish how big is the influence of surgical correction of strabismus angle at children with esotropia on development of binocular vision, in relation to conservative treatment. The examinees were grouped in two groups, the first one with children treated by a surgery and then by orthoptic-pleoptic treatment, while the other group is composed of children treated by conservative orthoptic method. Each group of children had 50 examinees – thus 100 examinees in total.

Establishment of binocular vision was followed in the period of one year. Examinees were from 4 to 8 years old. After a year of treatment, it could be seen that the first group examinees reached far better results than those from the second group. In the first group, 1,8% of examinees reached simultaneous perception, 72% of them gained fusion along with simultaneous perception, and 20% of examinees reached all three levels, including stereovision. In the second group, 26% of examinees developed simultaneous perception, 28% of them developed fusion along with simultaneous perception, and all three levels were reached by 8% of examinees. It is important to say that 38% of examinees from the second group did not show improvement in treatment and after a year remained without binocular vision. It may be concluded that even at small values of strabismus angle it is recommended to make a surgery and establish orthophoria prior to conservative treatment because in that way qualitative binocular vision can be reached. Similar research was conducted by Dorn and Petrinović-Dorešić (2008), whose aim was to show stereoscopic acuity at strabismus and ametropic amblyopia. The research was conducted on patients aged from 1 to 25, who were divided into two subgroups: the subgroup with strabismus amblyopia (the patients with amblyopia on one eye and mainly with early appearance of strabismus) and a subgroup with refraction amblyopia, caused by missing proper correction of refraction error. Patients with strabismus amblyopia are further divided into two groups: those treated by surgery and those who did not undergo a surgery. The patients examined were those with esotropia, exotropia and microstrabismus. Type and size of strabismus angle (esotropia) and type and size of refraction error had a significant influence of obtained values of stereoscopic acuity showing impairment of stereopsis. Thus, it was noted that the greatest absence of stereovision was present at patients with esotropia, 83% of them who underwent a surgery and 55% of those who did not undergo the surgery.

Similar results were reached by Shaouly and co. (1994) whose aim was to examine clinical characteristics and long-term post-surgical results at infantile esotropia. They classified 103 patients (206 eyes) with infantile esotropia and followed them for 8 years after the surgery from what four groups derived. 28 out of 103 patients (27%) has subnormal binocular

vision, 24 (23%) had microtropia, 43 (42%) has a small deviation angle and 8 (8%) had a great deviation angle. Acuity of 20/30 or better was maintained at 174 out of 206 eyes. In the group of patients with subnormal binocular vision (28), the eyes kept horizontal position. However, 6 of 30 patients in the group with microtropia and 11 of 43 patients in the group with small deviation angle lost stability of horizontal eye position. They found out that two variables, latent and manifest nystagmus and persistent amblyopia at the time of surgery, had bad influence on post-surgical results. However, at patients with smaller pre-surgical deviation angle and at patients who underwent a surgery prior to the first year of life, it showed that it is possible to reach optimal results (subnormal binocular vision) or reach desired results (microtropia). Thus, the authors recommend a surgery after the treatment of amblyopia and whenever possible during the first year of life. Also, surgical experiences of Čelić and co. (2004), which refer to the group of patients operated from strabismus during the period of five years, up to the third year of life, 10,6% of children underwent a surgery. Most children who underwent a surgery were 3-7 years old, i.e. 33,2%, 7-14 years old, i.e. 23,7% and a relatively high number of adult patients, i.e. 28,9%. During this period, a slight increase of a number of surgeries was noted, while the age at the time of surgery was moving towards the younger children.

Čelić and Dorn (2004) made some researches which refer to the group of 50 children with infantile esotropia who underwent a surgery at the age 1 to 4. The time of surgery at children aged 1 to 2 was present in 16% cases and if strabismus angle was big. 44% of children underwent a surgery at the age 3 to 4. At first year of life, no child was subjected to a surgery because parents did not agree on it at such early age. Surgeries were made after the second year of life when it is more possible to make an accurate diagnostics and certain conservative treatment was conducted. Strabismus angle was often big, up to 30°, at 50% of patients.

CONCLUSION

As afore mentioned, surgical treatment is mostly indicated upon completed conservative therapy, i.e. upon orthoptic-pleoptic treatment, when occlusion is conducted with appropriate correction (binoculars) first and then the treatment of amblyopia or at least improve vision at poor-sight eye. The purpose of surgery is to reach binocular vision and esthetic effect as a psychological problem. Upon the surgery, whereby orthophoric position of eyes or approximately orthophoric position is reached, such a condition may remain throughout the whole life, but it can be changed, too. Parents must be always said that another surgery will be probably needed, especially in case of big angles. Apart from this, in most of cases, patients must wear appropriate correction after the surgery (binoculars), do muscles exercises (muscular training) and convergence exercises, as well as continue with occlusion therapy, pleoptic and orthoptic treatment if normalization of vision is not reached before the surgery, i.e. continue with medical-defectological treatment.

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СТРАБИЗАМ КОД ДЕЦЕ И ЊЕГОВ УТИЦАЈ НА ФУНКЦИЈУ БИНОКУЛАРНОГ ВИДА

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АПСТРАКТ

Циљ истраживања је испитивање квалитета бинокуларног вида постоперативно код езотропије. Испитана је повезаност величине угла страбизма, узраста, благовремености оперативног третмана и квалитета бинокуларног вида. Истраживањем је обухваћено 57 испитаника са езотропијом код којих је извршен оперативни третман. Подаци који су кориштени за ово истраживање прикупљени су из историја болести испитаника, лијечених у Кабинету за ортоптику и плеоптику Клинике за очне болести, Универзитетског клиничког центра у Тузли. Старост испитаника била је у распону 3 до 14 година. Истраживање је обухватило три периода посматрања и то: иницијални преглед, период после операције и годину дана након операције. Резултати истраживања указују на потребу благовременог третмана, ране детекције, односно, раних систематских прегледа деце предшколског узраста и превенције страбизма и амблиопије.

Кључне ријечи: езотропија, узраст, оштрина вида, величина угла страбизма, амблиопија, бинокуларни вид, ортоптичко-плеоптички третман, превенција, систематски прегледи