Prevalence of Amblyopia Species in 7 Year Old Children

7 YAŞ GRUBUNDA AMBLİYOPİ TÜRLERİNİN PREVALANSI

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Summary.

Purpose: In this study, we aimed to determine the prevalence of amblyopia and the related factors among the primary school students in our region.

Materials and Methods: We planned to evaluate the first class students of 22 primary schools, from different socio-economical and culturel parts of the city. The cover test, measurement of visual acuity with Snellen chart, measurement of refractive errors with autorefractometer, macroscopic examination of anterior segment with light and direct ophthalmascopy were applied to each student.

Results: A total of 2386 students, of whom 63 were girls, and 63 were boys, were studied over in the screening and 126 of them (5.28%) were diagnosed to have amblyopia according to the etiological criteria. Strabismic amblyopia, anisometropic amblyopia, mixed amblyopia, and deprivation amblyopia had been found in 26 (20.63%), 50 (39.68%), 14 (11.11%), 36 (28.57%) students, respectively.

There was no statistically significant difference between girls and boys ($p>0.05$).

Conclusion: It is evident that the school screening programmes to be made to prevent the lifelong negative impacts of amblyopia which is a frequent cause of visual impairment contribute to appropriate timing in treatment, to a great extent.

Ozet

Amaç: Bu çalışmada, yöremizdeki ilkokul çağındaki çocuklarda ambliyopi prevalansı ve ilgili faktörlerin saptanması amaçlandı.

Çalışmanın Yapıldığı Yer: Kırıkkale Üniversitesi Tıp Fakültesi Göz Hastalıkları Anabilim Dalı tarafından il merkezindeki sosyo-ekonomik ve kültürel açıdan değişik kesimleri yansıtan 22 ilkokulun birinci sınıflarını kapsayacak biçimde planlandı.

Materyel ve Metod: Her öğrenciye örtme testi, Snellen eşeli ile görme keskinliği ölçümü, otorefraktometre ile ölçüm, ışık ile makroskopik bir ön segment muayenesi ve direkt oftalmaskopi yapıldı.

Bulgular: Taramaya katılan toplam 2386 öğrencinin 63'ü kız, 63'ü erkek olmak üzere 126'sında (%5.28), belirlenen etyolojik kriterlere göre ambliyopi tanısı kondu. Şaşılık ambliyopisi 26 öğrencide (%20.63), anizometropik ambliyopi 50 öğrencide (%39.68), mikst ambliyopi 14 öğrencide (%11.11), deprivasyon ambliyopisi 36 öğrencide (%28.57) saptandı.

Kız ve erkek öğrenciler arasında istatiksel olarak anlamlı bir fark saptanmadı ($p>0.05$).

Sonuç: Görme bozukluklarının çok sık nedenlerinden biri olan ambliyopinin tüm yaşam boyu sürebilecek olan olumsuz etkilerinin önlenebilmesi için yapılacak okul taramalarının tedavideki uygun zamanlamaya katkısının önemi açıkça ortadadır.

Key Words: Amblyopia, School screening, Visual impairment

T Klin J Med Res 2000, 18:126-133

Anahtar Kelimeler: Ambliyopi, Okul taramaları, Görme bozuklukları

T Klin Araştırma 2000, 18:126-133

Received: Feb. 2, 2000

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Amblyopia comes from the Greek word meaning dull sight or blunt sight. It is not a simple phenomenon and results from a variety of sensory and motor abnormalities (1). There may also be

changes in binocular summation and suppression, some loss of binocular function and loss of stereopsis. As well as loss of Snellen and visual acuity, loss of sensitivity to the contrast in a stimulus, distortion, and an increase in the magnitude of the crowding effect or separation difficulty have been reported (1,2). In other words, amblyopia is the reduction in the best corrected visual acuity either unilaterally or bilaterally, for which no organic cause can be detected on physical examination of the eye and which, in appropiate cases, is reversible by therapeutic measures (2). It is a frequent cause of unilateral visual impairment (3). It is also reported to be the third most frequent cause of unilateral blindness in several studies (4-6).

The rates of prevalence can vary between 0.2% and 5.3% according to the criterion of age and visual acuity in the population sampled (7,8). It can be low in the preschool or school population as well as in military population whereas it may be higher in the clinical studies since the cases are referred or had some complaints. Therefore, the wide range school screening programmes are more appropriate for the exact sampling (3).

The economic and psychological costs of amblyopia might be underestimated. Otherwise, healthy young adults with amblyopia may find that their vision is not adequate for certain occupations or sporting pursuits that require stereopsis. As long as vision is not lost in the good eye, unilateral low vision usually is considered only a mild handicap (3).

Amblyopia is associated with strabismus, refractive errors and form deprivation (1). The refractive states particularly prone to cause amblyopia are bilateral hypermetropia and anisometropia; in the latter condition the difference between two eyes causes the image of one eye to be consistently clearer than the other (9). Form or stimulus deprivation is the consequence of defective pathologies as in cataract and corneal scaring. In the vast majority of cases amblyopia is unilateral, but it may be bilateral with form deprivation and, rarely, with high refractive errors.

Amblyopia only affects the developing visual system during the so-called sensitive period, which extends from birth to the age of seven. During this period the visual system is not uniformly sensitive to insults. It is relatively robust in the first 3 months of life and most sensitive from about 3 to 36 months, after which the sensitivity gradually decreases (10).

Amlyopia is amenable to treatment only during the sensitive period, and in general a favorable response to treatment is dependent upon the age onset, length of deprivation, and age at presentation. Thus an early diagnosis is important and the appropriate therapy should be started as soon as possible. It must be remembered that, different types of amblyopia do not behave identically and therapy is not uniformly succesful (9).

The purpose of this screening study was to assess the prevalence of amblyopia and to reveal the other neglected vision threatening ocular pathologies among the 7 year old children.

Materials and Methods

This study was carried out in the primary schools at Kırıkkale city center, between February 1999 and June 1999, by Kırıkkale University, Faculty of Medicine, Department of Ophthalmology. The students of 22 primary schools from different socio-economic and cultural parts of the city had been studied over. Their transport to ophthalmology clinics provided by the busses and the examinations were done by the same doctor (A.E.) with the assisstance of a nurse.

Before starting the examination teachers were asked to answer the following questions for each student: (a) Does your student seem to see well? (b) Does your student hold objects unusually close to his/her face when trying to focus? (c) Do the eyes appear straight or cross?

During the examination the students were given some necessary information. First, the external examination of the eyes, consisting of a pen-light evaluation of the conjunctiva, sclera, cornea and iris, were performed. Then, the movement of eye to different directions was controlled, following the Hirschberg test, after which the cover test had been applied to both eyes. After the central fundus and optic nerve examination with direct ophthalmoscopy, the autorefractometer (Canon R-50) measurement was performed. Subsequently, the visual acuity had been measured with Snellen chart by the nurse. Those who couldn't be able to read

Table 1. Classification of amblyopia due to etiological reasons

	Strabismic		Anisometropie		Mixed		Deprivation	
	No	%	No	%	No	%	No	%
Girl	12	9.52	25	19.84	8	6.34	18	14.28
Boy	14	11.11	25	19.84	6	4.76	18	14.28
Total	26	20.63	50	39.68	14	11.11	36	28.57

There is no statistically significant difference between sex and visual acuity (p>0.05).

and were found to have refraction error with autorefractometer were invited to the policlinic once more in the following day, and examined with cycloplegic upon which the prescription of the eyeglasses were completed. Information were also given about the necessity and importance of routine controls.

Amblyopia was diagnosed if the best-corrected visual acuity was 7/10 or less in both eyes or the visual acuity of two eyes differed by two or more Snellen lines and was not attributable directly to any underlying structural abnormality of the eye or visual pathway. The overall cases were classified as being mild if the vision was in the level of 0.6-0.8, moderate in the level of 0.2-0.5, and severe in the level of 0.1 and less. Myopia, emmetropia, and hypermetropia were defined as a spherical equivalent of less than -0.5 diopter, between -0.5 and +0.5 diopter, and more than +0.5 diopter, respectively.

Amblyopia was evaluated in four categories according to etiological factors (3,9):

(a) Strabismic amblyopia - with strabismus without anisometropia or high refractive error,

(b) Anisometropic amblyopia - if the refractive error of two eyes differed by more than 1 diopter, no strabismus was present,

(c) Mixed amblyopia - in which the two above conditions co-existed,

(d) Stimulus deprivation amblyopia - was assigned as the cause if congenital cataract, ptosis, corneal scarring or other media opasities obstructed vision during the sensitive period of visual development. High refractive errors that were uncorrected in childhood also were classified as stimulus deprivation amblyopia (2,3).

Table 2. Distribution of the cases diagnosed as strabismus amblyopia

Visual acuity	Sex			
	Girl		Boy	
	No	%	No	%
0.6-0.8	6	4.76		4.76
0.2-0.5	3	2.38	**5**	3.96
0.1	3	2.38	3	2.38
Total	12	9.52	14	11.11

There is no statistically significant difference between sex and visual acuity (p>0.05).

Statistical analysis was made by SPSS for windows, version 8.0. The Chi-square and Fischer's exact chi-square tests were used.

Results

In a total of 2386 students, consisting of 1106 girls (46.35%) and 1280 boys (53.64%), 126 (5.28%) were found to have amblyopia, as to the etiological criteria determined, out of which 63 (50.00%) were girls and 63 (50.00%) were boys (Table 1).

Strabismus amblyopia (Table 2), anisometric amblyopia (Table 3), mixed amblyopia (Table 4) and deprivation amblyopia (Table 5), were diagnosed in 26 (20.63%; 12 girls and 14 boys), 50 (39.68%; 25 girls and 25 boys), 14 (11.11%; 8 girls and 6 boys) and 36 (28.57%; 18 girls and 18 boys) children, respectively (Figure 2).

In comparison of the five group, there was no significant difference statistically between the girls

Table 3. Distribution of the cases diagnosed as anisometropic amblyopia

Visual acuity	Sex			
	Girl		Boy	
	No	%	No	%
0.6-.08	10	7.93	8	6.34
0.2-0.5	9	7.14	11	8.73
0.1 and below	6	4.76	6	4.76
Total	25	19.84	25	19.84

There is no statistically significant difference between sex and visual acuity (p>0.05).

Table 4. Distribution of the cases diagnosed as mixed amblyopia

Visual acuity	Sex			
	Girl		Boy	
	No	%	No	%
0.6-0.8	1	0.79	1	0.79
0.2-0.5	4	3.17	3	2.38
0.1	3	2.38	2	1.58
Total	8	6.34	6	4.76

There is no statistically significant difference between sex and visual acuity (p>0.05).

Table 5. Distribution of the cases diagnosed as deprivation amblyopia

Visual acuity	Sex			
	Girl		Boy	
	No	%	No	%
0.6-0.8	7	5.55	6	4.76
0.2-0.5	7	5.55	10	7.93
0.1	4	3.17	2	1.58
Total	18	14.28	18	14.28

There is no statistically significant difference between sex and visual acuity (p>0.05).

and boys with respect to visual acuity (p>0.05). When compared generally, no statistical difference was found between the boys and girls (63 girls, 63 boys) (p>0.05).

The girls diagnosed as deprivation amblyopia, were found to have myopia + microcornea, traumatic glaucoma, central leucoma adheran, postoperative aphakia, and perforating injury + strabismus. And in the boys two were bilateral postoperative aphakia, another two were ptosis (bilateral in one of them), and one was deprivation amblyopia due to leucoma. The remaining 26 were found to have high refractive error (13 were boys and the other 13 were girls).

Out of the girls with strabismus it was esotropia in five, exotropia in six, hypertropia in one, and, out of boys, esotropia in ten and exotropia in four. The number of cases in which the visual acuity was determined to be 0.1 in one eye and higher in the other was 29, 16 to be girls and 13 were boys. In, however, two of them 0.1 level of visual acuity was bilateral.

Same diopter miopia and hypermetropia are classified in the same degree of diopter. The highest spherical value in the cases we found to have myopia was -21.50 D, and was +14.00 D in the ones we found to have hypermetropia. Refraction error distribution in the cases with amblyopia has been shown in Figure 1.

Discussion

The definition used here for amblyopia is a condition due to visual deprivation and/or abnormal binocular interaction for which no organic cause can be detected by, for example, ophthalmoscopy and which is potentially reversibl by therapy. Any intervention to prevent serious amblyopia has to be based on our knowledge about normal versus abnormal visual development. Since our ability to prevent the development of amblyopia is limited, an important task in good eye health care is to detect manifest amblyopia at a treatable stage. Programs for screening amblyopia have therefore been instituted in several countries (11). Thus, the reasons causing amblyopia are being detected, diagnosed and treated. An abundant literature describes that the three main causes of amblyopia are strabismus, refractive errors and visual deprivation (3,9,11,12). The questions addressed here are: How can we separate normal from abnormal visual development? Can we, with our present knowledge, predict which children will develop amblyopia?

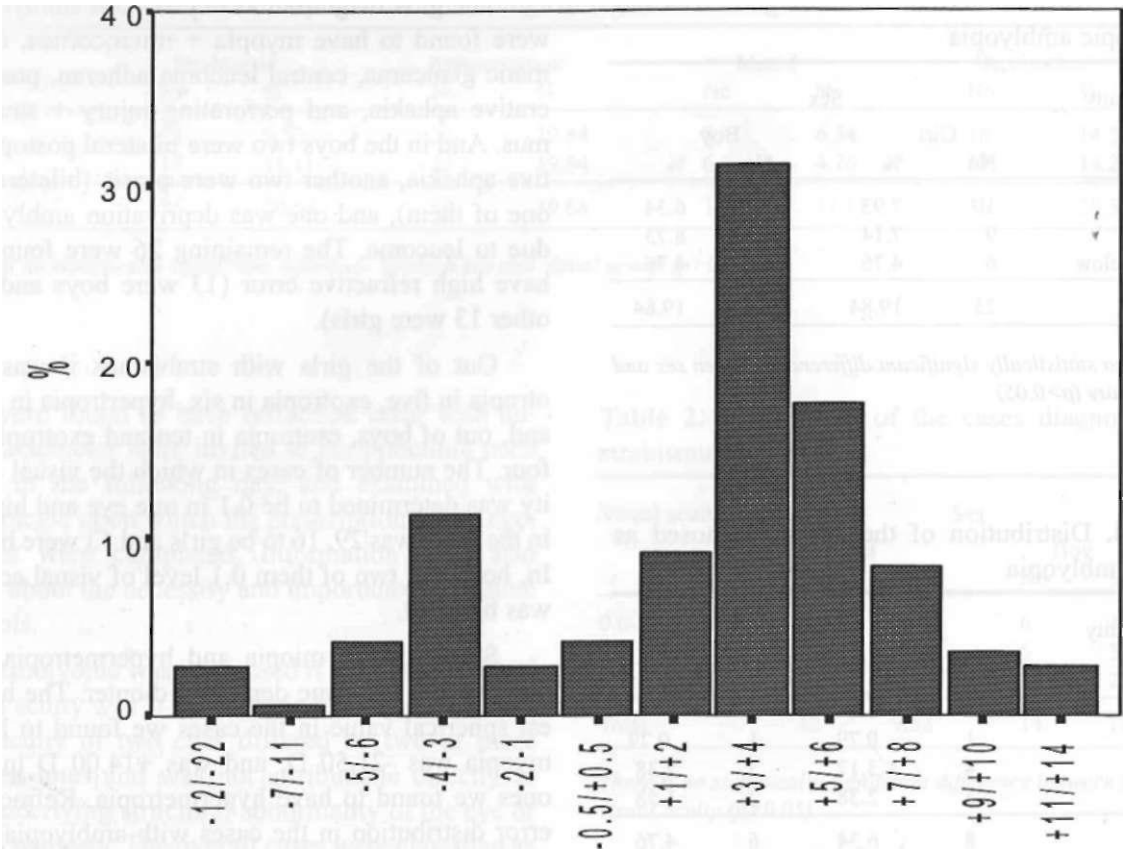

Figure 1. Distrubition of refraction errors in amblyopia cases.

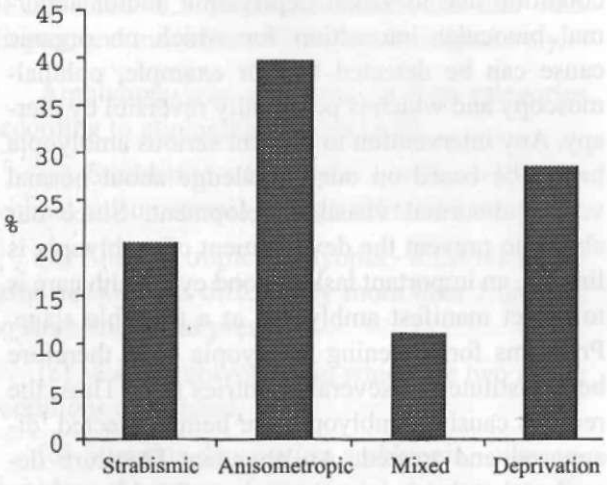

Figure 2. The types of amblyopia.

Can we prevent amblyopia before it starts by knowing these factors? How can we detect amblyopia at an age when it is still treatable in most cases? (11).

There are 3 periods in the development of visual acuity and in the development of ocular dominance (1). During the first 3 to 5 years of life, acuity develops from less than 20/200 to near 20/20, as measured by tests that exclude any crowding effects (13). During these years, acuity can be reduced by the various forms of deprivation. However, amblyopia is not confined to the first 3 to 5 years of life, but can result from strabismus or anisometropia at any age,from several months to 7 or 8 years of age (2). Recovery of acuity loss to amblyopia can occur in even older individuals. Eye care professionals have obtained positive results after sustained treatment of teenagers, and in a few cases of adults who are affected by amblyopia (14,15). Thus, one can talk about 3 periods for acuity: the period of development of visual acuity (birth to 3-5 years of age), the period during which deprivation is effective in causing amblyopia (a few

months to 7 or 8 years of age), and the period during which recovery from amblyopia can be obtained (time of deprivation to the teenaged years or even into the adult years) (1).

During the past 20 years, basic science has shown that there are different critical periods for different visual functions during the development of the visual system. Visual functions processed at higher anatomical levels within the system have a later critical period than functions processed at lower levels. This general principle suggests that treatments for amblyopia should be followed in a logical sequence, with treatment for each visual function to be started before its critical period is over. However, critical periods for some visual function, such as stereopsis, are not yet fully determined, and the optimal treatment is, therefore, unknown (1,16).

Previous studies of amblyopia prevalence have found a wide variation from 0.2% to 7% (17-19). Sources of variation in amblyopia prevalence estimates include the methods used to sample and screen the population. In general, lower amblyopia prevalence rates are found in preschool screening programs (20,21). Accurate visual acuity in young children is difficult with testing often performed using single projected letters (21,22). Because of the crowding phenomenon in amblyopia and using single projected letters or pictures in preschool screening programs, screening visual acuity may be overestimated so that some children with amblyopia may be missed (21). Since we used Snellen letters in our study and our population was primary school children, our amblyopia prevalance was higher with respect to preschool screening programs.

The rate of amblyopia in the population including 2386 subjects within our screening study covering the first class primary school students was 5.28%. In developed societies and various studies it was reported as 1-7% besides its variability in frequency (23,24). The prevalance of amblyopia in our country reported between 0.5% and 3.3% (25-32).

The rate in our study is higher than the rates recorded in the other studies in Turkey. This diversity in the rates can be explained, as in many other articles, by the age of population involved in the screening and the limit assumed in visual acuity for amblyopia. We took visual acuity as amblyopia criterion and defined this criterion in the material and method section. Since there isn't any limitation stated for amblyopia in the studies of Ekinciler (25), Unlii (31) and Zilelioglu (30) it may be considered that the diversity in the results could be the'outcome of upper limits taken for visual acuity. Turach (26) et al, on the other hand, has considered that any difference of two lines on the visual acuity chart is accepted as a diagnostic criterion for amblyopia. In that study, children aged 5-12 were screened. Since 7 year of age was the only group screened in our study and the older age groups in the others, some symptoms of amblyopia could have been possibly eliminated.

In five of the groups, separately, the number of boys and girls were similar and we couldn't find any statistically important difference between them with respect to visual acuity ($p>0.05$). When the students with amblyopia taken into consideration as a whole the visual acuity was not statistically significant between the girls and boys ($p>0.05$).

In our study the types of amblyopia according to the etiological criteria determined among the students were strabismus amblyopia (20.63%), anisometric amblyopia (39.68%), mixed amblyopia (11.11%) and deprivation amblyopia (28.57%). Ozan et al, have been reported that the eyes with refraction error constitute the bigger group with 95%, and other reasons account for the smaller group with 5% in a classification of amblyopia within itself (32).

On the other hand, Shaw has reported the rates of 45%, 17%, 35% and 3% for strabismus, anisometropia, mixed and deprivation, respectively. He attributed high strabismus rates in his own study to recognition of this pathology by families and immediate surrounding earlier than others and to low age group (9). He found higher anisometropic amblyopia in children over 5 years of age. There is no information regarding ametropic cases in the amblyopia classification of Shaw. We included these cases into the deprivation group according to the references provided due to which the number of cases that were found to have deprivation amblyopia was higher. Sjostrand has stated that families

better informed can notice the opacities and strabismus, however refraction errors such as anisometropia and ametropia with no obvious symptoms can be diagnosed only by an ophthalmologic examination (11).

Attebo has reported rates of 19%, 50%, 27%, and 4% for strabismus, anisometropia, mixed and deprivation, respectively, and attributed high rate of anisometropia to high age groups (3).

Lithander, who took visual acuity limit below 0.5 as the basis for amblyopia, in the study he conducted over primary school students, has reported a rather low rate than western societies. In this study he was reported a value of 0.92% for amblyopia in which strabismus was 0.48% and anisometropia was 0.44% (33).

The main finding is that children with strabismus presented earlier than did those with anisometropic amblyopia; the age at presentation for the children with both srabismus and anisometropia was somewhere between those for either condition alone (9). Only 15% of the children with anisometropic amblyopia presented before the age of 5. There are four possible explanations for these differences (9). First, strabismus is often observed by parents or others, whereas anisometropic amblyopia tends to go unnoticed because there is no accompanying sign. Therefore, in this study it is stated that 57% of the children with strabismus amblyopia had been referred by general practitioners (9). Secondly, refraction changes rapidly in infancy but much less thereafter, and the degree of anisometropia is necessary to cause amblyopia. A third explanation could be the low population coverage by the screening process. The fourth, and probably the major, reason for the detection of amblyopia in the absence of strabismus is inadequacy of the preschool vision test (9).

Amblyopia is a clinical situation which starts to develop in childhood and disable the person in some respects in adulthood. Indifference of the society, family, teacher and even the doctor can play a role in such an outcome. The visual impairment causing permanent, damages unless it is treated in childhood can deprive the person of many jobs and hobbies.

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